POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

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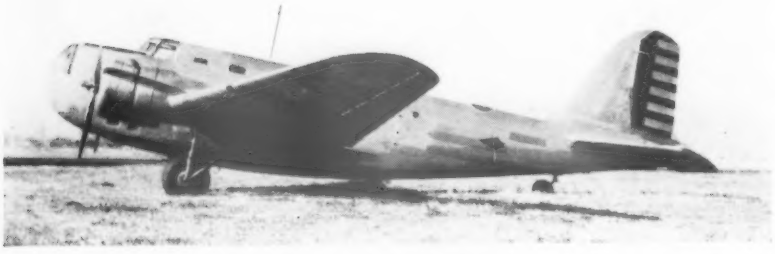
Recent Trends in the Design of

Boeing YB-17 U. S. Army Super-Bomber.



Douglas B-18 U. S. Army Bomber.

Northrop A-17 U. S. Army attack plane.

Curtiss XA-14 Twin engine attack plane.

by

GORDON SEAR WILLIAMS

Official photos by the courtesy of the U. S. Army Air Corps and U. S. Navy, Bureau of Aeronautics.

THE year 1936 saw many important events take place in the military aviation history of the United States. Not only were appropriations larger than in former years but many new and unusual types were developed for Uncle Sam's fighting forces.

In the past year the monoplane, and particularly the low wing monoplane, has entirely dominated the military aviation picture and has even made serious inroads on Naval aviation, a branch of our Nation's Defense long a stronghold of the biplane.

Army aviation has seen the development of its first pursuits in the 300 mile an hour class and of super-bombers with speeds approaching this figure. Attack aviation has branched off into the twin engined classification and should probably now be classed as light bombers and ground strafers.

Although the rapid-firing cannon has yet to see actual use in the Air Corps, many manufacturers are experimenting with this latest development in the science of aerial warfare. Boeing, Douglas, Vultee, Lockheed and Consolidated are known to be planning future planes with provision for the mounting of these lethal weapons.

Naval aviation has finally accepted the low wing monoplane for carrier use and when deliveries are completed during 1937 we will be the first nation to make use of this highly efficient type of Naval plane. The low wing single seater has not been accepted for carrier use but biplanes of very clean design have attained speeds nearly as great as existing monoplanes so that this branch of our Navy is still far ahead of that of any country.

It would be well to review the newer planes of the past year and see just what has taken place in the theory and practice of airplane design and construction in such a short space of time.

Army contracts for the fiscal year of 1935, which meant deliveries for 1936, called for a total of 364 ships, all monoplanes. These were as follows: 50 Consolidated PB-2A biplane pursuits, 110 Northrop A-17 attacks, 103 Martin B-10B twin engined bombers, 71 Douglas 0-46A observation planes, and 30 Seversky BT-8 basic trainers.

Similar contracts for the present fiscal year of 1936-37 call for delivery of 13 Boeing YB-17 bombers, 1 Boeing XBLR-1 long-range bomber, 3 Curtiss YIP-36 single place pursuits, a service test order of YIA-18 Curtiss twin engined attacks, 90 Douglas B-18 bombers, 120 North American 0-47 observations, 77 Seversky P-35

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Army and Navy Aircraft Types

pursuits and numerous non-tactical ships such as trainers and transports.

Every airplane represented in these contracts is a monoplane so it now may be taken as an established fact that the Air Corps is definitely in favor of the performance and strength characteristics of this type of ship.

The first of the super-bombers built by Boeing has already been test flown at this writing and the next 12 are rapidly nearing completion. These all metal mid-wing monoplanes are probably the most formidable aerial weapons ever devised.

They can keep up with all but the very fastest pursuits and can ably defend themselves from enemy attack due to gun turrets placed at strategic points.

Facilities for over 3 tons of bombs are provided and normally five turrets are used. Crew is from 7 to 10 men and range is said to be around 4,000 miles with full load. Four 1,000 horse power Wright Cyclone "G" type engines power these huge YB-17's and are said to give them a top speed of around 285 miles an hour.

Very little is known of the second type bomber now being built by Boeing, other than that it is much larger than the YB-17. It will be delivered sometime during 1937 and should be an even greater sensation than the "299," which was the progenitor of the YB-17 type.

The designation "XBLR-1" stands for "Experimental Bomber Long Range." The damage which could be done with a fleet of these bombers would be difficult to estimate as they will be practically impregnable to outside attack.

It might be well to mention the Boeing No. 281 at this point. This ship is the export version of the Army's popular P-26A and to date has been sold in numbers to China and Spain where they are in active service at present.

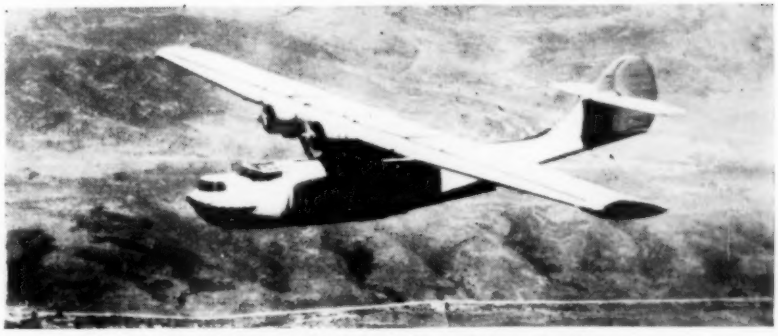
Although not actually a new biplane, data has just become releasable on the Bellanca XSE-2 Naval Scout. Of rather a strange type for this class of aviation the XSE-2 is a high wing monoplane somewhat resembling the "Airbus" in general lines.

A Wright "Cyclone" was used in the first model built, the XSE-1, but the last type built, XSE-2, used a Twin Whirlwind engine of 700 horse power. Top speed is rated as 212 miles per hour when equipped with the 830 horse power Cyclone.

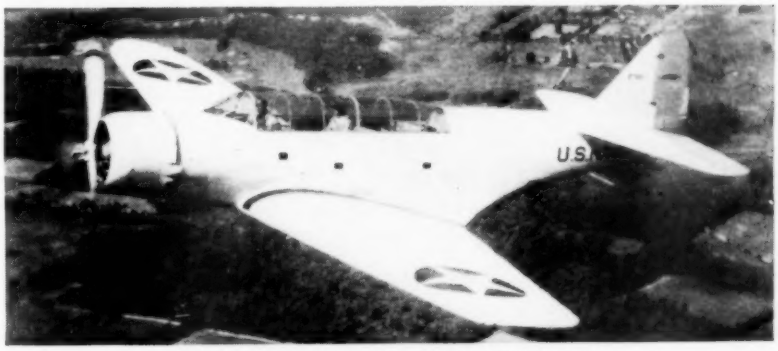
Consolidated has on hand orders for approximately 170 of their new flying boats of the PBY-1 class. The Navy is evidently much pleased with the performance of these all metal boats and plans call for basing them at important bases along the Pacific Coast and in Alaska. Powered with two Twin Wasp engines these high wing monoplanes have a top speed of approximately 180 miles an hour. Retractable wing-top floats are this ship's most unusual attraction.

The most unusual Curtiss plane of the past year was certainly the XA-14 twin

Vought XSB2U-1 U. S. Navy scout bomber.



Consolidated XPBY-1 of which 170 are on order.



Douglas XTBD-1 U. S. Navy Torpedo Bomber.

Vought V-143 U. S. Army Air Corps Pursuit plane.

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The Seversky BT-8 Army low-wing.

North American BT- 9.

Curtiss SOC-1 Scout Observer.

North American BT-9A Basic Trainer.

engined attack job. This ship was of composite construction, featuring a monospar wing with metal covered leading edge and fabric rear portions. Fuselage is wholly of metal and provides a well-streamlined enclosure for pilot and gunner. Four high calibre machine guns are located in the sharp bullet-like nose.

Although the experimental model, using two Twin Whirlwind R-1510 engines, was known as the XA-14, production ships will be called YIA-18's. They will not be painted, having the natural alclad finish that is becoming so popular on military as well as commercial craft.

The hollow leading edge of the XA-14's wing is designed to be completely watertight and provides an effective flotation chamber in case of forced descent into the water.

The Assistant Secretary of War, Harry M. Woodring, recently stated "The Curtiss YIA-18 is generally credited with being the fastest twin-engined military airplane built to date. It shows that America continues to maintain her leadership among the nations of the World." An order amounting to $1,259,235 was placed for these fast ships.

Curtiss made a radical departure from its famous line of single seater "Hawks" in the new XP-36 monoplane pursuit. Although originally using a 700 horse power Wright "Twin Whirlwind" the service test order will use the new Cyclone "G" of 1,000 horse power.

The P-36 is larger than most single place ships used in this country and more nearly approaches the larger, speedier "Interceptor" used abroad. It has a span of 37 feet 3½ inches and a length of 28 feet. It is said to have a top speed of over 300 miles per hour when equipped with the 1,000 horse power Cyclone.

Curtiss Navy orders delivered in 1936 were mainly of the type SOC-1 scout-observation biplanes. 175 of these efficient carrier and shipboard convertible land or seaplanes were ordered and many are now in active use. They use a 550 horse power Wasp and feature controllable cooling, and single strut landing gear and utmost reliability.

Automatic wing slots and manually operated flaps are used to bring the landing speed to the desired low level. The first SOC-1, incidentally, was delivered in four and one-half months after the contract was awarded.

The last Curtiss order for the fiscal year of 1936 was for the type SBC-3 scout bombers. This small compact biplane is a modification of the former XF12C-1 two seater fighter and the XSBC-1 and SBC-2 scout-bombers. The XSBC-3 first appeared in 1936 and was entered in competition with the Vought XSB-U-1 and others at the Anacostia testing station.

This ship has a wing span of slightly over 34 feet and uses a 700 horse power Twin Wasp Junior engine, a type much in favor with Naval officials at this time. 84 of these trim all metal scout bombers are being built at present and will likely be used aboard our two new carriers "Yorktown" and "Enterprise."

The final evolution of the time-honored Curtiss "Hawk" appeared in 1936 and was

known as the "TYPE IV Hawk." Over 50 of these 250 mile an hour pursuits have been built to order for the Chinese Government where they are now in active service.

The Douglas Company of Santa Monica has held its place in the spotlight throughout 1936 and is destined to continue this place in the lime-light of aviation due to its many orders on hand. Known orders include 114 TBD-1 torpedo-bombers for the Navy and 80 B-18 twin engined bombers for the Army Air Corps.

The TBD-1 is the first low wing ship of this class to be purchased for carrier use and should prove a valuable type. Folding wings of ingenious design are used, so that although a low wing monoplane, it takes up no more room than the conventional biplanes used heretofore. A Twin Wasp Senior engine of 830 horse power is used and should give this interesting plane a top speed in the vicinity of 230 miles an hour, or much faster than any corresponding type in use in other Navies of the World.

The B-18 Army bomber will supplant to a large extent the many Martin B-10's and B-12's now in use. These huge mid-wing monoplanes use two 930 horse power Cyclones as power plants and although rather clumsy in appearance are said to be much faster than existing types of service bombers. A crew of 6 men is normally carried. A retractable rear gun turret is perhaps this ship's most unusual feature.

Grumman is the one American company which has continued the development of the high speed biplane instead of branching into monoplane design. Although all planes built by this company are much alike the two latest single seaters, F3F-1 and XF3F-2, are even faster and cleaner in design than earlier types.

The type F3F-1 is now in use in many of our fighter squadrons used aboard ship and is powered with the Navy's favorite, the Twin Row Wasp Junior engine. The experimental type XF3F-2 single seater makes use of a much larger engine, using a 1,000 horse power Cyclone, which gives it a top speed of nearly 300 miles per hour.

Although a comparative newcomer to the ranks of American military aircraft manufacturers, the North American Aviation Company seems to have "taken hold" and is now hard at work on 120 0-47 three place observation monoplanes for the Army Air Corps. This all metal mid-wing ship is the answer to the fervent prayer of the nation's observation squadrons for a larger more roomy ship.

Existing observation types have been found inadequate in the majority of cases for the work demanded of them. It was found that existing observation planes, with large mapping or oblique cameras aboard, could not defend themselves due to the cramped quarters for the harried gunner-observer-radioman.

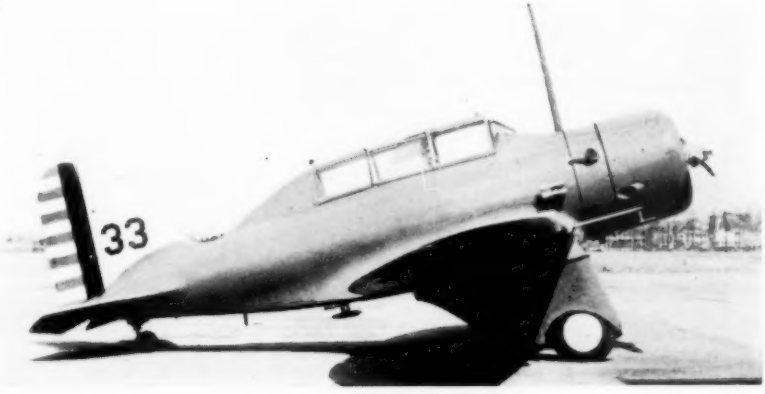
The O-47 has a wing span of over 46 feet and uses the popular Cyclone engine as its power plant. The pilot is accommodated above the leading edge of the wing with rear gunner immediately behind him.

In the belly of the ship are ample facilities for the installation of various types of cameras and observation equipment. Top speed is said to be close to 250 miles

North American XO-47 Army Observation plane.

Douglas O-46A 2-Place Army Observation type.

North American Dragon experimental bomber.



Seversky BT-8 Basic trainer.

an hour, which should make it the fastest observation ship in use today.

Numerous BT-9 and BT-9A trainers have been delivered to the Army's training center in Texas and to reserve squadrons by the North American people. These low wing basic trainers have a fabric covered fuselage and an all metal wing.

Landing-gear is of the full cantilever type and mounts streamlined tires with small "half-pants" completing the fairing. The BT-9 and BT-9A differ mainly in the latter type's having equipment for gunnery training. This same type ship is also offered for export as a two place or single seater fighter or bomber with engines ranging from a Lycoming (for primary training) to a Cyclone for actual fighting duties. Its speed in the latter case is 260 miles per hour, or 270 with a retractable landing gear.

Northrop has continued along its usual distinctive lines in producing the A-17 Army attack and its adaption for carrier aviation the BT-1 dive bomber. They both make use of the Twin Wasp Junior engine of 700 horse power and are of course all metal with exception of movable control surfaces, which are of metal framework with fabric covering.

The A-17's have proved to be very efficient in actual service use and constitute standard equipment in our attack groups today. The XBT-1 dive-bomber is a radical departure from usual carrier planes of this type, as all preceding aircraft of this class had been biplanes.

The BT-1 makes use of a new innovation in Northrop design practice, a semi-retractable landing gear that folds back into a fairing which projects below the wing. The multi-spar wing construction used in Northrops evidently does not lend itself well to the normal fully disappearing landing gear and it is for this reason that an external housing had to be used. 54 of these speedy BT-1 Navy bombers are to be delivered during 1937.

Among the producers of American military planes surely no builder has grown faster than the Seversky Company. Rising from a small concern employing but a few men to one of the major companies in the United States in the space of but a few years is their amazing story.

First producing only high speed commercial amphibions, this company has now entered the military field and Major Seversky's long practical experience as an Army engineer has already shown to advantage in his designing the BT-8 and P-35 Army basic trainers and pursuits.

Seventy-seven of the stubby little P-35 single seater pursuits are now being built to order for the Air Corps and are said to have a top speed in the neighborhood of 300 miles per hour. First deliveries of these Twin Wasp powered ships are expected around the middle of 1937.

The Chance Vought Corporation, builders of the world famous "Corsair" biplanes for the U. S. Navy have recently turned to other types. Their two latest jobs are both of the low wing monoplane type and reflect the ever increasing trend to employ this method of construction in military and naval aircraft. Their Navy scout bomber XSB2U-1 has proved so successful that 54 are now being built for carrier operation.

The V-143 single place Army pursuit was in the 1936 competition that was finally won by Seversky and their P-35 single seater. In official tests at the Vought factory this all metal fighter showed a top speed of 250 miles per hour when equipped with a 525 horse power Wasp Junior engine. Engines up to 750 horse power may be fitted, however, and with this installation speeds approaching 300 miles an hour are expected. This ship was actually built from designs of the ill-fated Northrop XP-948 Army pursuit that disappeared during a test flight over the Pacific in 1935.

Aircraft now being developed for delivery in late 1937 and 1938 include a huge four engined Boeing flying boat, a Twin engined Northrop, a Lockheed transport of much larger proportions than the popular "Electra" and many others equally as interesting.

From all indications our entire Army Air Corps will be operating at speeds above the 200 mile an hour level, with the inclusion of basic trainers, and the Navy is not far behind.

Pursuits and some of the better bombers have come close to the 300 mile an hour speed long dreamed of and when present experimental planes are completed 300 mile an hour airplanes will likely be as common as our 200 mile an hour craft of today.

Martin B-10B U. S. Army Air Corps Bomber.

New Instrument Panel for United

This shows the new United instrument panel in practical service.

THE MOST elaborate instrument panel test desk ever used in transport plane testing was devised by United Air Lines engineers to feel the "pulse" of the two 1,150 h.p. motors on United's new Mainliners, now in non-stop service between Chicago and New York.

The instrument panel, installed in the cabin of the luxury Mainliners for tests conducted by United, Pratt and Whitney and Hamilton Standard Propeller to determine the best propeller and engine combination, was particularly intricate due to the fourteen cylinders on the twin-row Wasp motors that power the ship. Heretofore, engineers have had but nine cylinders to calculate from.

An engineer, seated at the desk, is able to take temperatures simultaneously at a large number of vital engine points that otherwise would be inaccessible. H. O. West, United's superintendent of maintenance, who took an active part in the preliminary motor tests (shown operating the panel in attached picture) points out that the panel supplements the instruments to be found in the pilots' cockpit.

The principal instrument is a thermometer of the thermocouple type from which readings are taken from twenty-two different points, such as cylinder heads, spark plug gaskets, carbureter air, oil temperature, oil in and out of the supply tank, oil into the cooler, blower temperature and temperatures at several other points of the oil cooler.

Other instruments used in the collection of this vital engineering data include oil pressure, pressure at front and rear of engine baffle plates, altitude and (not shown in attached picture) pressure below the carbureter. The layout was used for more than fifty hours in flight tests on the west coast and at Hartford, Conn., where the ship was put through paces to satisfy United that the engine installation was such to maintain proper operating temperatures under the severest kind of operating conditions.

Another instrument which played a big part in United's initial tests with the Mainliners was the Bowser fuel consume-meter for accurately determining fuel consumption at various altitudes and powers.

Here and There at the Air Show

by SWANEE TAYLOR

Highlights on the exhibits, personalities and personnel at the great New York aviation show that was held in the Grand Central Palace, New York City. It was a fine display—well attended.

COMING after a long seven-year drought, the January National Air Show, held in musty old Grand Central Palace, was eagerly drunk up by aviation-thirsty New Yorkers who came literally in droves. It is variously estimated that about one in every three hundred inhabitants of the Big Town saw the show.

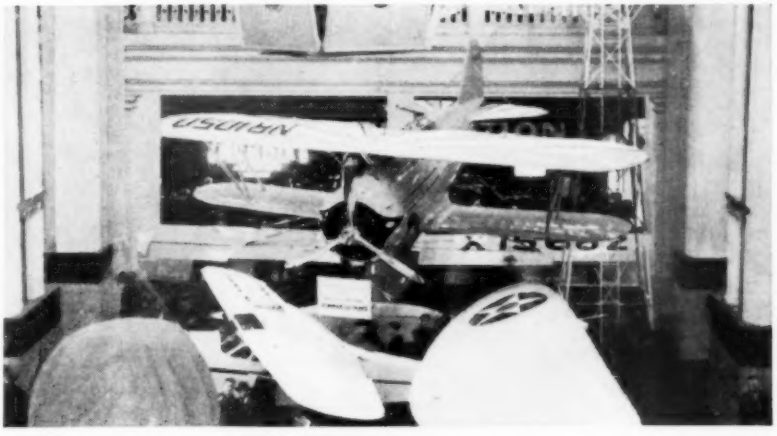
From the box-office standpoint they came out of the red on about the fifth day. As a result, the Aeronautical Chamber of Commerce officials perked up pleasantly during the last days. While the sponsors, Aviators' Post 743, American Legion, made enough money to rehabilitate an entire Ohio Valley flood family who had lost everything.

* * *

The show itself offered some 30-odd ships for the public to examine, feel and ask questions about, with about 100 booths exhibiting everything from a patented windshield wiper to a vast array of gadgets, by Bendix, which in their very complexity completely dominated the south wall on the main floor.

Military machines were conspicuous in their scarcity. Only one manufacturer, Seversky, exhibited his product. Although Maj. Al Williams brought his bright orange "Gulfhawk" (Grumman fighter), from the ceiling in a wicked power-dive. The Army and Navy exhibits had each a Seversky and a Grumman.

Many a visitor went away wondering just how far behind our Industry is in air defense. Which, it goes without saying, is an injustice to American manufacturers of military equipment.

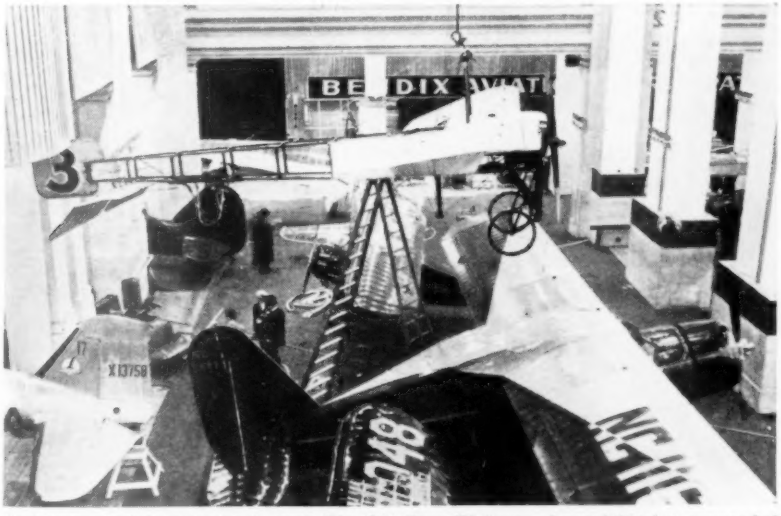


Al Williams' Gulfhawk Grumman was suspended from the ceiling and proved to be one of the most attractive exhibits.

On the ground floor the Fairchild, Cessna, Ryan, Monocoupe, Luscombe and the Argonaut Amphibian took the play away from the other commercial types. These makes aroused more genuine interest than Michel Detroyat's latest Paris importation. Maybe the sensible price range had something to do with it.

* * *

The moderate priced ships, up on the mezzanine, all did a rushing business. Optimism among all the company heads runs high over the outlook. Beaming happily they all voiced the opinion that sales problems are now over. From henceforth their worries will center about production. Where to get the necessary manpower!



And then—just as a contrast—was this 1911 Type XI Cross-channel Bleriot, suspended just a few feet from the ultra modern Grumman and Seversky ships.

Every one of the schools did bargain basement business. Hundreds of red hot leads poured in, and each individual school signed up more than enough students to pay for the sales costs involved. Stewart Tech. is adding an air lines dispatcher course; Roosevelt School is going to enlarge right away, and Parks Air College finds that it is already beginning to outgrow its commodious quarters.

Never has the Industry seen such enthusiasm backed up by cash in hand.

* * *

Along with a justifiable complaint about a "service charge" being hung on the exhibitors' tickers, the other major moan was about the dust inside Grand Central Palace. Red and smarting eyes were epidemic. (Pain in the eyes, and a pain somewhere else, huh?)

* * *

The Barney Baxter (a new comic strip by pilot Frank Miller), exhibit sponsored by the N. Y. Daily Mirror, was the kids' delight. They had their pictures made sitting in Barney's wingless fuselage and were allowed to shoot at a moving airplane of a screen free of charge.

And so was Roscoe Turner a delight to young and old alike. The National Broadcasting Company sent Roscoe and the entire cast of "Flying Time" on to take part in the Show.

* * *

The calamity of the show was the theft of a prized and expensive Sikorsky model from the Berryloid booth. The clever thief came in early one morning and after pretending to dust off the exhibit opened the case with a screwdriver. Then the special cops kindly gave him a pass out of the building.

* * *

It would have done your heart good to see our Managing Editor, "Skipper" Rath-

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bun, hob-nobbing with his Early Bird cronies. (Although he did spend his first afternoon in town down at the aquarium, photographing fish.)

* * *

Sam Breeder, sales manager for Ryan, left for San Diego with 18 signed contracts in his pocket. Maybe he and his boss, T. Claude Ryan, will believe me now when I say, All God's Chillun gettin' wings.

* * *

Our Ladybirds—or Powder Puff Pilots if you must—gave an excellent account of themselves. Tomaso, the noted caricaturist, decorated their booth for them. Then he had to stand a public trial for insulting his subjects. Betty Huyler Gillies, Ruth Nichols, Louise Thaden and Teddy Kenyon were the complainants. "Judge" Ronny Gall (Wright Aeronautical publicity) sentenced the hapless artist to wear a kiltie for life with lace-trimmed woolies underneath.

* * *

The show was a celebrity-worshipper's paradise. The aviation world was present practically to a man. Ocean flyers, speed flyers and over-weather curiosity seekers were stumbling over each other. Radio, stage and screen likewise were well represented. For example, what Lanny Ross and Jack Miller, Kate Smith's band leader, did to feminine hearts, little Mitzi Mayfair, dancing star, did to masculinity and she climbed sooooooo gracefully in and out of the ships.

* * *

The "staging" of what little entertainment there was was definitely bad. It lacked dignity, continuity and coherence. Besides, it didn't make good sense. The management will do well to bear in mind that it takes much more than a set of loudspeakers and a few wishes to make for acceptable entertainment.

Another thing, the horns in Grand Central Palace are atrociously places for anything except music. To understand a word you have to stand directly beneath them.

* * *

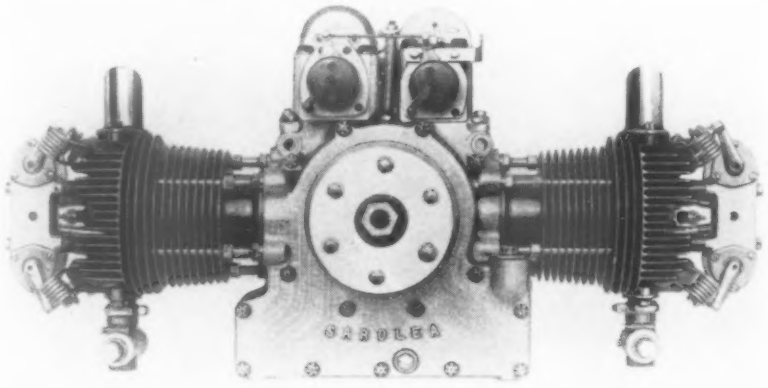
From late reports the hotels along Lexington Avenue, facing the Palace, managed to recover from the concentrated rush of aviators. Things are dropping back into normal, but it's doubtful if the bellhops and clerks will forget the session to their dying days.

Required Reading . . .

Almost forgot to tell you to buy, read and give away, *Flying For 1937* ($1.50), published by the Aeronautical Chamber of Commerce for those who can struggle along without all the technical details. After you're done with it, hand the book around among those of your friends who are scoffers. For it tells the tale of last year's accomplishment so vividly as to convince the most skeptical doubting Thomas. The chapter on Private Owners, for example, is startling in its context.

The author is Howard Mingos, a hardy perennial in the field of aviation writing whose capable and enjoyable style is topped only by his complete familiarity with the subject aeronautics. Put this one on your "must" list.

THE SAROLEA LIGHTPLANE ENGINE—An Opposed Type Aviation Engine



Propeller end of the Sarolea 2-cylinder opposed lightplane engine that is said to show a noteworthy performance.

THE lightplane engines described in the columns of POPULAR AVIATION during the past few months have been, for the most part, converted automobile engines, although in a few cases some rather interesting two-cycle designs have been presented.

The Sarolea engines, which are produced in Herstal, Belgium, by Maison Sarolea, S.A., well-known builders of motorcycle engines, fall into a slightly different class. Naturally these engines follow motorcycle engine lines in some respects, but their construction really conforms to the most modern practices employed in building the more powerful types of aircraft engines.

The two models, both of which are air-cooled two-cylinder opposed engines, are almost identical in design. The principal difference is the cylinder bore, the smaller "Epervier" having a 80.5 mm. bore and the "Vautour" a 88 mm. bore, and with a 90 mm. stroke in each, the respective displacements are 916 cu. cm. and 1100 cu. cm. Both engines use a 5.5 to 1 compression ratio and are reported to weigh (minus propeller hub) 99 lb. complete. The smaller engine delivers 25 hp. at 3000 r.p.m. while the larger one gives 32 hp. at 2750 r.p.m.

Little of a strictly unconventional character can be found in the Sarolea design. The aluminum crankcase, which contains a three liter reservoir for oil, is provided with means for mounting either on the base or back flange. The cylinder barrels are chrome-nickel steel forgings, to which are held the cast alloy iron heads by means of long bolts extending to the crankcase.

Special steel valves seat at an inclined position in the hemi-spherical combustion chamber, and they are controlled through rocker arms and duraluminum push rods, with torsion (rat-trap) springs holding them to their seats. Pistons are of aluminum, and the big ends of the connecting rods are each mounted upon a double row of rollers.

There is a double pump to circulate the oil, one which delivers it under pressure to various parts of the engine and the other to return the excess in the crankcase to the reservoir beneath. Unlike most engines in this low power range, dual ignition is provided by two magnetos, one of which is equipped for impulse starting. Also, there are two carburetors and these are attached to the downward facing inlet port flanges on the cylinder heads.

Fuel and oil recommended are ordinary aviation gasoline and Castrol, the latter being a blend of castor and mineral oil.

The "Tipsy" lightplane, built in Belgium and equipped with the 2-cylinder Sarolea lightplane engine. This little plane was described in a past issue of POPULAR AVIATION.

Al Williams' New Grumman

by ROBERT McLARREN

A complete account of the Grumman "Gulfhawk" flown by Al Williams, the noted pilot, and which proved a great attraction at the recent New York Air Show.

AL WILLIAMS, world-famous stunt and speed flyer and a familiar figure wherever flyers gather, has always flown the fastest and most powerful ships available.

His trim orange and white pursuit ships have accompanied his athletic figure to every city in the United States which can boast an airport. Always, he has chosen the latest in speed, power, and maneuverability for his sky steed.

Nowhere, are these qualifications met so successfully as in the military planes of the United States Air Forces and it is to this source he has turned. Governmental experimentation and the secrecy surrounding newly developed types have always hampered him in securing the ships of his choice.

However, through his sincerity of purpose, patriotism, and honesty of endeavor to promote American aviation, governmental officials have cooperated with him to the greatest possible degree where rules or regulations did not prevent it.

As a result he flew a ship superior to any other commercial plane in the United States or the world, and it was through this cooperation that he procured his famous Curtiss "Hawk" pursuit at a time when this model was operating in U. S. Army and Navy squadron service.

Recently the name of Grumman has risen to a high rung in the ladder of aviation, particularly in the construction of high speed fighting craft of the U. S. Navy. With each successive model Grumman has presented to the world the fastest and most powerful ships.

Al Williams watched these trim little biplanes with their wheels tucked snugly into their bellies scream through the clouds, with an overpowering sense of envy. Al made a promise to himself that some day he would have a ship like that, a plane faster and more powerful than any other like plane in the world.

Showing the triple-blade propeller and characteristic landing-gear of the "Gulfhawk" Grumman plane. Technically, this is a Grumman Model GG-2, a special type incorporating details of a number of Grumman models.

He conferred with his sponsor but was met with the stern query: "What's wrong with the Hawk?" Al was expecting this reply so he answered with all the reasons he could summon.

Conferences resulted but still no success. "Company economy due to recent slumps in trade make it impossible to meet your request," and "It will be impossible to concede to your wish until our sales increase" soon became phrases as familiar to him as his own name. Patiently he concealed his determination but set his hard, tanned jaw for the battle.

A few weeks ago a high pitched scream reverberated across the clouds in the East. In an instant it had become a sonorous roar and a brilliantly orange biplane shrieked across the sky and disappeared with a final bellow of deep throated power to the hills in the West. This sight meant but one thing to the small group of flyers and engineers as we stood in the door of a hangar at Roosevelt Field: Al Williams had won!

When Al Williams first conferred with Grumman engineers, he told them that he wanted a combination of all the best points of the several different Grumman designs. Firstly he chose the F3F-1 model because of its superior speed. Secondly, he selected the most powerful nine cylinder radial engine in the world; the sensational Wright "Cyclone" G series.

To incorporate this engine into the ship he had selected, he had to use the design features of the XF3F-2, a Grumman fighter still undergoing experimental tests for the U. S. Navy. Naturally, armament details were omitted which changed the cowlings and tail surfaces of the ship, the latter because the carrier hook used for deck landings was not needed.

Construction began on the ship and within five months the trim little biplane was trundled out of the factory for the first time. Al could hardly express his joy and watched the test flights like a child with a new toy. Pronounced "O. K." by the test pilot, Al hopped in the speed skyster and tried her wings for himself. When he landed his face was frozen into a grin so wide he could scarcely speak.

Technically, the ship is Grumman model GG-2 and is an all-metal biplane with fabric covered wings and tail surfaces. The wings are of aluminum alloy construction built up of two spars and dural ribs. It is built in two sections which are joined in the middle of the fuselage and supported on a set of cabane members. The lower wings are of similar construction and are attached to the fuselage on either side. Horizontal tail surfaces are braced by means of a single strut member attaching to the rear beams of the fin and stabilizer.

The pilot's cockpit is entirely enclosed,

Another view of the Grumman GG-2 showing the exceptionally deep body and the tail group.

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the wind shield being of non-shatterable glass, and the sliding hatch portion of pyralin. An extremely complete set of instruments has been arranged on the reflection proof dash board. Complete sending and receiving radio, gyroscopic pilot, and the regulation flight recording instruments are standard equipment.

The retractable landing gear is of the new F3F-1 type which is smaller and faster in operation. Manually operated, it can be raised without excess effort in 10 seconds and lowered in half that time.

A constant speed Hamilton three-bladed propeller provides the ship with astonishing take-off characteristics. Under Al Williams' unexcelled handling this striking "Gulfhawk" can start from a dead stop, take off, and climb to 2,000 feet in exactly 1 minute which is a challenge to any other plane in its class in the entire world!

Regulation size fuel tanks are installed which contain 110 gallons of gasoline, 10 gallons of oil, which is fuel sufficient for a non-stop flight of over 600 miles. Special equipment installed in the GG-2 include a smoke writing attachment on the starboard lower wing, an air wheel tail wheel rotatable through 360 degrees, and Goodrich deicer equipment. The brakes and shock absorbing equipment are all of Bendix design and the landing lights are of the A-6 type manufactured by Adams and Westlake.

Al Williams has incorporated several novel design features which he himself has designed. Among these are a special baggage compartment which contains all radio equipment, cockpit and engine covers, first aid equipment, tool kit, and emergency rations and water should he meet with an unexpected forced landing.

In the cockpit is his own specially designed instrument board with instruments placed in positions to which his eye has become accustomed through his long years of flying.

A special radio ear phone hangs at his right elbow and on the dash is a special slip of cardboard upon which are written the maneuvers through which he goes while participating in air shows. While twisting and looping about in the air behind the roar of 1,000 horsepower, it is not exactly easy to remember precisely where you are or what's next on the program so Al has it written neatly down.

Maximum speed of Al Williams' latest sky mount is in excess of 280 miles per hour while cruising speed (65% power) is 230 miles per hour. Landing speed is only 60 miles per hour, which proves the wide range of speed with this type ship.

Al Williams has become a legend among stunt and speed flyers and with this new distance annihilator, the Grumman GG-2, much can be expected of him. Perhaps he will add to his total of 11 world's records in the very near future. This man and this ship should prove an unbeatable combination in the air.

Thousands of people had an opportunity to closely examine this ship at the recent New York Aviation Show, and many were the favorable comments made upon this ship with its fine design and appearance.

END

The Westland "Lysander" Plane

(See front cover drawing)

A three-quarter front view of the Westland "Lysander," an ultra-modern army co-operation plane.

LAST to emerge from secrecy of the new military airplanes and seen for the first time in public is the Westland "Lysander" High-Performance monoplane designed for aerial duties in liaison with the Army, including artillery-spotting, reconnaissance and photography.

Designed and built by Westland Aircraft Ltd., the new machine is a high-wing monoplane with enclosed cabin for pilot and observer. The wings are tapered towards the tips and are fitted with Handley Page automatic wing slots and flaps to enable the plane to land slowly and to ascend from small field—an essential detail in the performance of an army co-operation machine which must frequently work in war from improvised landing grounds near the front line.

The pilot's compartment is located just in front of the wings, giving him a wide field of vision around the machine. Much care has gone to making the accommodation for the crew of two—pilot and observer—really comfortable. The compartments are roomy, can be quickly and easily opened, and are fitted with controllable heating, ensuring a degree of comfort equal to that of a modern commercial airplane.

Like all of Britain's new war planes, the Westland monoplane is notable for admirable streamlining and suppression of every excrescence that might add to head resistance. The undercarriage is fixed but is of cantilever streamlined form with carefully shaped fairings around the struts and wheels.

Power is supplied by a Bristol Mercury super-charged air-cooled radial engine which drives a controllable-pitch airscrew. Around the engine is an adjustable cowling, fitted with controllable devices to assist cooling.

Performance figures of the machine may not yet be published, but it is known to be much faster than any army co-operation aircraft yet produced. Wing span is 50 feet and length overall 30 feet.

The wing has a single spar, the torsional stress in which is resisted by the external "vee" bracing which also resists bending moments.

This side elevation of the "Lysander" shows the typical English outlines of the Westland "Lysander."

This Aerial Monkey Business

by JESS LAUGHLIN

An amusing story of the only chimpanzee wing-walker in the world, now taking the leading part in a film drama under a rigid contract. And he carries no chute!

HE'S NOT afraid to do anything. He has played nothing but leading parts since he made his first appearance. He has a devastating sense of humor. And he contents himself with giving his director the "bird" when he feels like talking back over something with which he doesn't agree.

His name is "Shorty"—short and easy to remember—not a romantic name, to be sure, but his audience is delighted when he turns on the heavy romance.

Shorty is a chimpanzee. As humorous and lovable as anything. His naturalness makes him a natural in front of the camera. At the time this is being written, Shorty is finishing the last sequences of a flying picture in which he performs as a wingwalker while several thousand feet in the air.

Unlike many of the other screen stars who for one reason or another are called upon to use a double, Shorty's manager hasn't found another "chimp" who can duplicate his star's feats.

This picture is the eleventh picture in which this intelligent animal has appeared. He has played various parts, ranging from a fireman to a cowboy, but this, his latest role, surpasses everything he has previously done. Shorty now has the (unenviable—Author's Note) reputation of being the only chimpanzee wingwalker in the world.

Without benefit of the safe feeling that we humans derive from the use of a parachute when we feel like taking a constitutional down to the end of the wing and back, he not only doesn't miss this cumbersome contraption, but is actually safer without it!

The wind in his face! Equipped with goggles and helmet, Shorty holds on with both his hands and his feet.

"Movie Star! Huh? On a diet all the time to keep my figure."

Paradoxically enough, he is much safer without a 'chute than with one. Were he to fall off (and he wouldn't think of doing anything so silly without taking the wing with him), and if the 'chute performed perfectly, he would be killed.

The reason is that due to his natural animal instincts he would start climbing the shroud lines of the open 'chute and try to get to the top of the thing. With his weight at the top, the silk canopy would collapse and form his burial shroud.

No, make no mistake, his owner and friend, John A. Haeseler would let Shorty do nothing that might cause his injury or death. The affection between this man and his animal friend is a touching thing and, if ever an animal had complete trust in a human, then that animal is Shorty.

With the traditional strength of the ape in his wiry, agile body, Shorty seems to enjoy hugely his "picture work." For example, in this air picture which he is just finishing, he was to walk out the lower wing of a biplane which was equipped with a flexible camera mount.

The ship was piloted from the front cockpit by the regular pilot for Shorty's air work, and Shorty was carried aloft in the lap of his owner. Clad in denim coveralls, a leather jacket (with zippers), a leather custom-made helmet, a pink silk scarf flying jauntily from his neck, he is the picture of airy nonchalance as he waves to his human friends who watch him as he disappears into the distance, on his way to work.

A Yale man who started collecting animals on his jaunt into Africa brought Shorty back, together with another younger chimpanzee. These two animals were sold to Mr. Haeseler, who gets as much pleasure out of them as they get out of their association with him.

Shorty is the self-appointed guardian of the younger "chimp," and when it cries for more food, he philosophically gives it part of his own. This will probably continue until Shorty feels that enough is enough, even of a good thing—and then there will be an end to all that.

Shorty's sense of humor never fails to send his public rolling in the aisles. Life is fun to him and he is fun for everybody else. Gentle and kindly, he never does anything actually mean. The only thing he doesn't like at first sight is a negro.

He wouldn't hurt one of them, but instinctively he seems to remember that his ancestors could always make the natives show the whites of their eyes by merely making a few experimental "passes" at them. To prove this statement I have seen him do a flying tackle at a negro he had never seen before and when this negro persisted in making friends, he finally rolled over on his back to have his ribs tickled—a privilege reserved for an accepted friend.

One day, at the airport, Shorty paid close attention to a mechanic who was busy at a job of greasing certain parts of the ship with a grease gun. Finally Shorty figured he had the procedure down pat. He waltzed over, politely took possession of the grease gun, applied the pressure

(Concluded on page 59)

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China's War Birds Will Have

by

JOHN WATKINS

This modern anti-aircraft searchlight battery is part of China's little-known modern army equipment. Japanese aircraft that return to bomb Chinese cities this time will have a bit of trouble.

WHEN General Chiang Kai-Shek, astute dictator of nearly all China, decided several years ago that war between his country and Japan is inevitable if China is to remain an independent nation, he came to the conclusion that a large and powerful air force would be one of the cheapest and most effective factors in a Chinese victory.

Having reached that conclusion, the sage Chinese ruler decided that the best ingredient for this bitter tea designed for Japanese consumption would be American airplanes. And since the airplanes had to be flown by trained pilots, who could teach his future military aviators better than the men who have the reputation of being among the finest pilots in the world?

Further comment is unnecessary; suffice it to say that General Chiang sent for an American to reorganize his pitiful little air force, build it to formidable strength, and form a flying school where young Chinese could be taught to handle their new steeds of war.

That American was Colonel John H. Jouett, former air corps officer, West Pointer, and holder of four army ratings—balloon observer, airplane pilot, airship pilot, and airplane observer—who had served in France, but resigned from the army in 1929 to fly, for an oil concern.

In 1932, amidst frantic pleas by the Japanese to the League of Nations, and disavowals of responsibility for their safety by the United States Department of State, Colonel Jouett and ten young air reserve officers who had completed their period of active duty with the air corps, five first class air mechanics and fifteen Consolidated training planes—exactly like those used at Randolph field—sailed for Nanking.

Among those ten young American pilots were, interestingly enough, Roy Holbrook, son of General L. R. Holbrook, now commanding the Philippine department and Christy Matthewson, Jr., son of the famous baseball player. At last reports, Holbrook was still in the Orient, while Matthewson had returned to the United States and gone to work for the Fairchild Aviation Corporation, Hagerstown, Md., where Colonel Jouett is now employed.

When Colonel Jouett arrived in Nanking he found that he was to be, in fact if not in name, absolute head of the future air forces of the country, director of the air school he was to organize, and supervisor of all aeronautical activities of the Nationalist government. For three years, the American officer efficiently went about the task of training pilots and creating an air force which would be strong enough to resist successfully a Japanese invasion.

In those three years, he purchased a hundred American training planes and turned out three hundred and twenty-five pilots. And Chinese aviators, trained by Americans, are just as adept in the air as is the average American pilot, he says.

As an illustration of the resourcefulness of the average Chinese student at the school, Colonel Jouett recently described to me how one of his flying cadets joined the Caterpillar Club. It is an interesting incident, deserving of repetition.

"While flying formation over Hangchow Bay," he said, "one of the cadets put his plane too far forward and chopped off the tail of the ship in front. The pilot of the leading plane had to bail out.

"After his 'chute filled, he looked down from an altitude of about four thousand feet, and discovered he was directly over the bay—and the water looked mighty cold and wet to him.

"Descending slowly, he began to ponder over his plight, wondering how he could

Jimmy Angell, noted American airman, is shown above at Los Angeles municipal airport instructing Chinese student pilots in the art of aerial camera gunnery. Having been trained here, these pilots will return to the Orient to pass on their knowledge to other students.

A Sting for the Enemy Now

possibly swim to shore in his heavy boots. By dexterous efforts, he managed to get his boots off, but then realized that if he made the shore, he would have to walk back to the field in his bare feet.

"Well, he dropped into the water with his boots in his hands. Looking around, he noticed that his chute was floating on the water, with the edges submerged and the center puffed out with air. So he paddled over and pulled the edges together under water, so that he had something resembling a blown up paper bag.

"The cadet then tied one of his socks around the opening, and using the chute as a water wing, managed to swim to shore. He returned to the field with his boots, parachute and personal equipment intact."

That is one example of the American-like resourcefulness of the modern Chinese, who is very much like an American in many respects. He makes a good student; about 14.8 per cent of the inexperienced applicants could pass the entrance requirements to the flying school, Colonel Jouett said, as compared to 14.7 per cent at Randolph field.

"I found that Chinese youths compared very favorably with American boys as far as flying ability is concerned," he told me. "Checking records at both schools (Randolph field and Nanking) I discovered that their progress was about the same, and, given one hundreds hours in the air, Chinese and American students would be advanced to about the same stage. If anything, I believe the Chinese youths can adapt themselves to flying more quickly than our boys, during the early stages of instruction."

But while the air school was of primary importance, the American head had another task—that of building up the air force.

He recommended that a five-year plan be inaugurated, in order that by 1938 the Chinese air corps could be built up to nine hundred modern war planes manned by a thousand pilots.

By January of 1936, shortly after Colonel Jouett returned to the United States, General Chiang had close to five hundred first class fighting ships—the most modern obtainable. Most of them are of American manufacture, and more are being purchased as fast as they can be built and delivered.

The Chinese are flying Northrop light bombers, the latest navy-type Vought Corsair observation planes, Curtiss-Wright and the Italian Fiat pursuit ships, and, within the past year, have ordered one hundred high speed Vultee single-engine attack planes.

Right here in Baltimore, within five miles of where this is being written, Glenn L. Martin is building twin-engine bombers for the Chinese. These big ships are not the same airplane used by the army air corps. Rather, they are faster, more powerful and superior to those Martin sold the army air corps in every respect. Each is equipped with two 900 horsepower Wright Cyclone engines. Captain Luther Chang, of the Chinese air force, is stationed at the Martin plant to supervise the contract. The first two Martin bombers left Baltimore on a British freighter in January.

General Chiang Kai-Shek is probably the most progressive-minded leader in China today. It was he who realized the ultimate importance of aviation to his country's welfare; it was he who obtained a group of American experts to give China's air force its beginning.

Although the Department of Commerce cannot release information on the types of aircraft exported to friendly countries, E. R. Strong, chief of the statistics and distribution section of the bureau of air commerce, told the writer that from "January 1, 1931, to August 31, 1936, the records of the Department of Commerce indicate that 453 airplanes, valued at $10,581,684, were exported to China."

Since the use of commercial airplanes is exceedingly limited in that country, it is safe to assume that at least ninety-eight per cent or more of the ships exported were designed and built for military purposes.

This isn't just a case of a nation arming to the teeth for purposes of aggression. Japan has made known its intentions toward China. Colonel Jouett says that the Japanese consider themselves mentally, physically and morally superior to any race on earth, that they apparently intend to dominate the world, and that they realize they must first dominate the Far East.

War between the two countries—the awakened China and the arrogant Japan—

(*Continued on page* 68)

Keystone-Loening amphibians—American ships—are one other section of China's widely versatile "baby" air force. The above photograph shows officers of the Cantonese 19th Route Army inspecting three of their aircraft.

XUM

Notes on the Bleriot Parasol Monoplane

(An Open Letter from Sydney Pickles)

This pre-war aerial chariot is pictured above with the brave Mr. Sydney Pickles in the ship's cockpit about to face the elements around Calais airport in France. Mr. Pickles "tells all" about the revered old Bleriot parasol monoplane.

IN THE old days, long before the war, the name of Sydney Pickles and his accomplishments in aviation occupied a prominent place in practically every issue of the English flying magazines. He was one of the best known and admired of the early pilots.

And, when a letter arrived from Mr. Pickles, the other day, we were delighted, as you can well believe. It seemed to move the past forward by a good twenty years and we are certain that our readers will have an equal pleasure in reading his letter which we reproduce herewith. Sydney Pickles is one of the real old-timers who has witnessed the growth of aviation from the very beginning and is a man whom we greatly admire.

With his letter, he enclosed a highly interesting Official Programme (Price: sixpence) of a "Scientific Aviation Demonstration" arranged and managed by Mr. Pickles during his 1920 barnstorming tour in Australia. This is an unusually well written and informative programme, but the feature that gives us the biggest thrill is the page advertisement of the Paling piano player in which a 1920 maiden, pompadour and all, is entertaining her boy friend with a player-piano. This sure brings back old memories—and how!

The Editor,
POPULAR AVIATION,
608 South Dearborn St.,
Chicago, U.S.A.

Dear Sir:

The reproduction of a photograph of myself, in an old Bleriot Parasol Monoplane, on the upper part of page 25 of your November issue, reminded me of the old days.

You may be interested to hear that this photograph was taken at the Calais airport, if a small dusty flying ground can be dignified as such, in France. I am enclosing the original photograph which I have removed from my pre-war and wartime photo album and would be glad to have it returned.

France traded a quantity of these ships to England in exchange for Lewis machine guns and I had the job of "ferrying" a fair number of them from Paris, France, to various points in England. I well remember the anxious stir amongst the French when I started stunting this machine on taking delivery at Buc airport near Paris. This type of Bleriot had not been stunted before.

It was the first high wing monoplane I had flown and I found it very comfortable, particularly for cross-country flying, the view being so much better than the mid-wing monoplanes I had previously flown.

It is hard to believe that I used to fly one of these "Parasol" Bleriots on Zeppelin defense patrol with a double barrelled shot gun clamped to the upper surface of the starboard wing and set at an angle so as to miss the propeller, when the gun was fired. The trigger and butt was just in front of your face. To satisfy those with Missourian tendencies I have photographic evidence.

These were the days before incendiary bullets and we tried all kinds of stunts with these shot guns including the old-fashioned two balls with a piece of chain between, which was supposed to rip open the Zep. If this did not succeed we were supposed to loose off a Verys light pistol and set it

(*Continued on page* 63)

Air Traffic Control

by JANE MEYER

IN the south wing of the terminal building of the Chicago Municipal Airport, overlooking the field, is the newly installed Airway's Traffic Control Room.

From one to three men are on constant duty. They are literally "the traffic policemen of the airways" and theirs is a highly responsible position. One mistake might cause a mid-air collision.

Plate glass windows give the men an unobstructed view of the airport. The other walls are lined with blackboards, partitioned so that a continual record of a flight, the pilot flying, time of the planes' arrival and departure, and the last radio report can be kept.

The Airways Traffic Control men are in constant contact with the operations departments of the airlines. Each conversation between operations and the men in the control room, is recorded on dictaphone records.

These are filed according to the date and the time. They are kept for three weeks, then shaved and used over again, that is, unless there is something of special interest that must be saved. In this way, any question regarding the operation or the order issued to a plane can be checked, and "passing the buck" is greatly eliminated.

The value of the dictaphone can readily be seen in the event of an accident, and the attendant inquiries that always ensue. Ground orders that were issued to the pilot can be determined instantly.

The Chicago airport Airways Traffic Control handles the airways coming to Chicago from Kansas City, Milwaukee, Detroit, Cleveland, Pittsburgh and St. Louis. The men who control traffic on the airways do not control it around the field.

They clear ships to the range of the airport control tower on the top of the terminal building. These radio men can tell approaching planes of other ships around them, of the direction of the wind and its velocity, what runway to use in landing, which gate to use in unloading passengers, mail and express. Departing planes are advised of ships in their path of flight, the runway to be used in taking off, and any last miaute dispatches.

Let's listen in with Alfred W. Carlson, TWA radio dispatcher, short wave station WAEO, in the Transcontinental and Western Air Lines hangar at the Chicago Municipal Airport. Al has the "lobster shift," coming on at 12 midnight and working until 8 A.M.

It's about time for the TWA Sky Chief, —known to the operations personnel as "Flight 12,"—to report as it nears Chicago en route from Kansas City.

Through the clear night air comes a voice: "TWA ship 325 to Chicago. . . ."

Switching a lever, Al Carlson leans forward—"Chicago to Flight 12—Go Ahead."

"Ship 325 to Chicago," Captain P. T. Scott at the big ship's controls replies. He continues, giving position and weather: "Crossed south leg of Sterling beam at

(*Continued on page* 56)

Micky McGuire—an Early Bird

by FLOYD LOGAN

Many of the old-timers will remember the hair-raising deviltry of the old-time, cow-pasture pilot, Micky McGuire. He used a full 60-horsepower to fly him over the humps but he gave them all a thrill.

THE whine of the little P-26 Low Wing Boeing was in the air—a test pilot putting it through its paces.

Silent Army airmen, alert to its every movement, keenly interested in every detail —stood about looking up, watching this new model pursuit ship in flight.

It banked; then on an even keel made a final dip as if in salute and straightened out for a landing—as sensitive as a race horse to the whims of its pilot. This was Selfridge Field a few months ago and now, as the ship came up on the line, the scene suddenly shifted.

It seemed that the officers around me were again civilians . . . the little ship dissolved before my eyes and there, in its place, I again saw a Wright model B pusher coming towards me . . . the place was Cicero Field . . . the year 1914. Unconsciously I looked around me for a glimpse of a familiar face—aviator Micky McGuire or "Sky High" Micky McGurrin—where were those boys? . . . But I knew only too well.

MICKY McGUIRE and I were partners in 1914. He was a dare-devil flyer. We bought Jimmy Ward's "Shooting Star" from Ike Bloom in Chicago and set out, kid-like, to make a lot of money—bird-like. In so doing we hooked arms with Lady Luck and took her along. We didn't know that then.

We did know that we had a handful of guaranteed contracts calling for twenty-minute flights in and over various towns. A man had given us these contracts. All that they called for was to cut a lot of fancy holes in the air without mussing up the scenery—to be considerate of house tops and not to scratch any paint off of barns. For which we were to receive the sum of five-hundred dollars cash in American money after each flight, a percentage of which was to go to the man.

That man was no other than the celebrated Bill Pickens, press agent extraordinary and manager of the team of the famous Lincoln Beachy and Barney Oldfield. And was he stuck out with contracts? So Micky and I packed our grips, made a few test flights with the newly purchased airplane, a Curtiss OX60 Pusher, and shoved off to keep the flying engagements.

Town No. 1 was South Bend, Indiana. There, after pulling his cap around backwards and donning a pair of goggles, he nosed the ship up out of a rope-guarded lot near the downtown section of the city. Higher and higher he rose, circling in huge spirals, soaring majestically—while hundreds of people gazed up in awe-stricken wonder.

Now and then, dazzling rays of sunshine reflected on the plane, then glimmered earthbound—like the dots and dash of the heliograph. Then, as advertised, Micky cut loose with a few aerial tricks, ninety-degree banks — tight figure-eights — roller-coaster zooms and, finally, streaked down towards the other side of town in one long glide.

Marvelous. The roof of my mouth was becoming sunburned watching these aerial antics. I looked at my watch. Not long now before we would be counting that first five-hundred—what a pretty thought.

The hum of the motor was in the distance but a building hid my view. I walked out to the main street to catch a glimpse of the "Shooting Star." One look and I froze in my tracks not believing my eyes—for here came the rip roaring Mick in a deafening burst of exhaust, arms and legs out-

And here is Micky McGuire who plays a role in this drama of the air.

stretched in midair barely six feet above the trolley wires and coming like a shell out of a heavy artillery gun! Some sight!

Naturally, I figured he was bent upon committing a novel form of suicide but the police thought differently. This was an amazing performance, indeed. So we counted our money and, furnished with a police escort, we departed from South Bend.

Again, at Napoleon, Ohio, Micky made a fifteen hundred foot nose dive coming out of it under the telephone wires and between a couple of poles. This he called, "The Dip of Death."

At Manistique, Michigan, where he flew on July Fourth, he took-off from a small baseball field surrounded by a high fence. Taking a big chance, he jumped the fence as a horse jumps a barrier and made a beautiful flight over the town. Then twice he made an attempted landing only to circle the field and come in lower each time.

The third time he pancaked over the fence, landing close to second base and rolling across the field at high speed towards the outfield fence. But town firemen caught the right wing fending off the ship just before it heaped headlong into what would have been known as a crash.

Micky was no "safety-first" pilot like the trained pilots on the airline transports of today—he was not even a pilot in the sense of the word. But Micky certainly was a FLYER and the champion Hedge-Hopper of America. Lady Luck was sitting right in his lap.

So time flew on and so did Mick, narrowly missing smokestacks—water tanks—flag poles—high tension wires and grandstands, with only a sixty horsepower motor to carry him over the bumps. It was always the heavy property owners and insurance men that gave him the genuine fond farewells.

He had become a liability to public safety—the Unknown Quantity in Life's Little Problems—a Second Cousin to Fire and Cyclone, and his friends always began with, "Oh are you living yet?"

Here it was August 2, 1914, and here he was still amongst us at breakfast in the Stratford Hotel, but ready any time to dash up and dodge a sky-line. It was a hot Sunday morning, the scorched prairie wind sweeping in from the West and warping everything in its wake.

Enter upon the scene, one Edgar F. (Sky-high) McGurrin, who specialized in parachute jumps, daytimes and in cabareting, nights. In one of his most recent jumps he had crashed through a sky-light ending up in a machine shop below. He sat down to discuss it and ordered something.

We were glad to see him for 'chute jumps from an airplane were a novelty. He would be certainly a swell added attraction to our Ozone Busting Act. So promptly we made him an offer to fall out of the "Shooting Star" with his sky-hook over county-fair grounds where we could get booking.

This would be a very uncommon sight indeed, and provide something for the customers to write home about. McGurrin accepted our offer on the spot, mentioning the fact that he had planned a jump that very afternoon at Cicero Field, from a plane piloted by Roy Francis from Reno.

I had a Graflex camera and here would be a swell chance to make some pictures of the parachute in midair from another airplane. Then if any turned out well we could use the best one for a cut on lithographs to advertise this new and novel attraction. Such jumps were scarce but pictures of such jumps were very very scarce —so scarce in fact that none of us had ever seen any.

I had made some exceptional shots of

XUM

McGuire kissing girls and girls kissing McGuire, also girls writing their names on the wings of the "Shooting Star." In fact I had a charming series of pictures of various young ladies sitting in the pilot's seat hiding behind a pair of goggles and an oversize leather helmet a la Aviatrix.

It was a stereotyped pose but very dramatic, for they sat at the controls and pointed at the sun, as if about to depart for that destination. I'll admit that the young ladies had difficulty in identifying their own pictures so complete was the disguise; but it was generally accomplished by one saying, "Look—here I am, I know that's me by my shoes."

But, this jump was something different and required thought. I would run up and down the Graflex scale of speeds like a piano tuner, only instead of striking keys I would take pictures. So that was settled.

McGuire phoned out to the field and secured permission to use a Wright Model B, a ship in which he had been giving me flying lessons on off days as it had a dual control. It was ideal for passenger carrying and Micky suggested that we make up a party of friends—take them out to the field and give them a few flights. This had all the earmarks of a gala day. So about two-thirty that afternoon we arrived at the field with a number of friends in tow.

The breeze was too stiff for parachutes but all right for flying so Micky rolled the Wright out on the line and warmed up the four-lung motor. After a lot of urging and coaxing we finally got our passengers on their aerial way, one by one, so I loaded the camera and warmed it up making pictures of our gang.

McGurrin packed his parachute in the bag container, now and then breaking into a picture with a monocle and a cane he had hollowed out for a cigarette holder. We had a lot of fun.

Roy Francis, the other pilot, put in his appearance and heated up his tractor ship as McGurrin attached his sky-hook to the undercarriage of the plane. Attracted by the air activities a lot of people had come on the field. The afternoon wore away without mishap—the wind died down and it was time for the jump.

McGuire, McGurrin, Francis and myself went into a signal huddle for the coming event. Francis was to take McGurrin up about two thousand feet then throttle his motor and open again. This was the signal for McGurrin to "bail out."

Meantime Micky and I in the Wright were to stall around two hundred feet below Francis, and off side, so that when the 'chute opened full we could go into a dive and spiral around the 'chute in tight corkscrew turns.

Francis would dive and get in the background someplace as atmosphere. This would give me a chance to shoot a lot of pictures, and they all sincerely hoped that, with all this trouble, I could at least get one good shot. Heh-heh.

So saying, we all piled in our respective places—hooked on our belts and taxied out across the field—Francis leading. Micky

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BIRD BOY ART SMITH—A. D. 1911

by MORTON D. LINDLEY

And here is Art Smith with the old-time grin and his fancy pearl buttoned shoes—famed from coast to coast.

A TRAIL of fire in the skies from an old Curtis Pusher—that was Art Smith flying at the San Francisco Exposition in 1915. Over and over looping and diving like a huge comet with a trail of fire produced by means of magnesium flares attached to the wing-tips of his plane.

Bird Boy Art Smith, the Indiana Wonder. That is the way they advertised the aviator of over two decades ago. Learning to fly in the early days was all it was cracked up to be. The aviator would taxi his flimsy plane, built from canvas, wood, and piano wire, back and forth across a none-too-large ball park or field until, becoming accustomed to the feel of his plane; then short hops until able to take off and land with perfect ease.

Figure eights, a most important stunt for the early aviator and one felt not qualified to the name "aviator" until able to do five "eights" in a row. Usually the flyer had many mishaps before ever getting into the air, with the unreliable engines of that time.

Art Smith built his first plane and learned to fly in 1911. He had many difficulties before becoming the greatest aviator of his time.

Art Smith was the first aviator to fly at night with magnesium flares attached to his plane and was the inventor of sky writing. When Smith came to San Francisco in 1915, to give exhibitions of his night flying, he by some mistake was ordered to make a night flight a day before he had previously planned—and the special type of fireworks had not arrived. It was necessary to scour the city for these flares while his airplane was being set up for the night flight. Smith found some among the exposition supplies that looked exactly like those he had previously used.

The flight was scheduled to take place at 11:30 P. M. and, right on time, Art Smith taxied his machine down the Marina and lifted it into the night air. After circling to reach an altitude of 2,500 feet, he was ready to make the first loop. Smith pushed the button that was to touch off the magnesium flares for the comet tails; then dipped the machine and made a complete loop.

Just as the machine came right side up, Smith touched the second button for the next loop. As he dipped the machine, a heavy explosion occurred and parts of his airplane whizzed past, just missing his face. With still another explosion, like the others, Smith turned his plane to make a landing. As he did so, fire broke out close to his face and his clothing caught fire. He dropped the machine in a vertical dip to blow out the flames and landed.

His manager helped to extinguish the fire by beating the flames with his coat. They found the lower wing ribs were blown off the wing beam and that some of the vertical struts were shattered. The "flares" were found later not to be flares at all but were really giant fire crackers, 12 inches long, which he had wired tight to his plane. If all these crackers had exploded, they would have completely wrecked his machine.

In the following year, Smith toured Japan, giving daring exhibitions in the cities and villages of his skill. He was feted by the people of the Orient; he received letters written in blood, and was

(*Concluded on page 63*)

The All-Metal Airship ZMC-2

by JOHN W. HIGGINS

The all-metal airship principle has proved highly successful and is a plea for this type in future military and commercial airship construction. This type of airship is exclusively American.

ON September 12th, 1929, there landed at Lakehurst, after a six hundred mile non-stop flight from Detroit, a metal clad rigid airship.

This ship was the first all-American conceived, American designed and American built rigid airship. It was also the world's first all-metal dirigible and its most successful career over the past eight years is indeed recommendation enough for the United States to concentrate on this type.

Our failures with the fabric type, which apparently is more suitable to hydrogen than the helium which we use exclusively, is a clear sign that the 8 percent. less lifting power of helium is too much of a handicap to overcome. For example, the Los Angeles arrived in America inflated by hydrogen, in keeping with American policy. This gas was then bled into the air and was replaced by helium but it is a matter of record that the Los Angeles was not as efficient as when inflated by hydrogen.

America should build airships suitable for the safe and invaluable gas we possess. We are a nation resourceful in our own right and imitation being out of our line it is not at all surprising we have reaped failure in this role.

The strength of the metal clad airship, particularly in the resistance of its hull to distortion under varying conditions, has been determined by laboratory tests and by actual operation. In large commercial sizes the metal clad can be made twice as strong with no considerable increase in weight over the same size fabric covered type.

The nature of the construction used in the building of a metal clad airship allows a more accurate means of calculating stresses. Increased safety, as well as more positive control, is afforded by the much greater range of internal pressure, which is more than three times that of the same size fabric type. This is a reason why many engineers regard the metal clad rigid airship as the real solution to final American leadership in the lighter-than-air field.

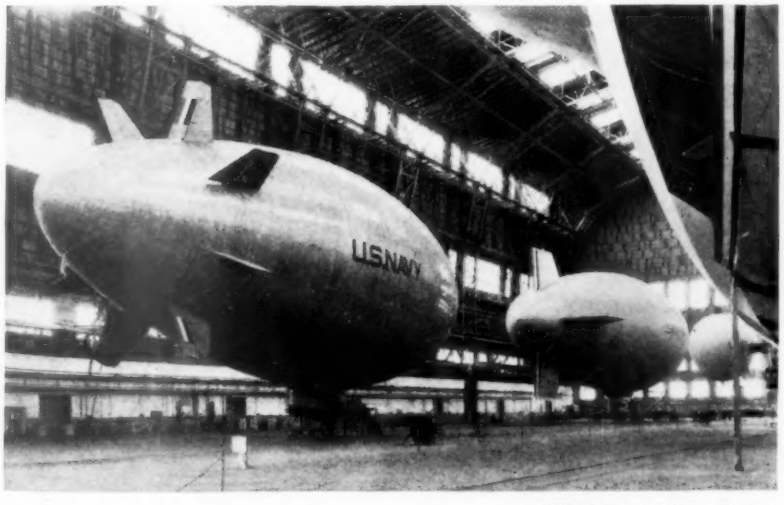
After the feasibility of a problem has been solved, and surely in the face of the long life and performance of the United States Navy metal clad ZMC-2 we must agree it is time for metal clads. Everyone recognizes that progress was spurred whenever metal replaced many of the things used in every day life.

One need only review the substitution of metal for steamships, railroad cars, bridges, etc., formerly built mainly of wood to realize fairness in the contention that America should build a larger metal clad.

Those who jump to the conclusion that such a ship would be too heavy, should look up the figures in the building of the ZMC-2 which will reveal that on completion in August, 1929, the ship was 127 lbs. under contract weight. The AKRON and MACON on completion were greatly over the weight called for and the efficiency of each suffered thereby.

The following table, which will reveal the general characteristics of the eight-year-old ZMC-2, is given below.

Official U. S. Navy Photo.
The all-metal airship ZMC-2 at Lakehurst, showing the all-metal hull. It has seen extended service and is particularly well adapted for helium gas.



Official U. S. Navy Photo.
The ZMC-2 in the hangar at Lakehurst on Navy Day, 1934. The Los Angeles, at the extreme upper right corner, is undergoing repairs.

Specifications

Length of Hull.....	149 feet 5 inches
Diameter of Hull (max.)	52 feet 8 inches
Fineness Ratio	2.83
Displacement of Hull	202,200 cubic feet
Total Ballonet displacement	50,600 cubic feet
Thickness of Skin..	0.0095 inches
Length of control car	24 feet
Width of Control car	6 feet 6 inches
Number of air valves	3

Number of gas valves	2
Number of fins	8
Total Fin Area.....	440 square feet
Total Elevator Area	190 square feet
Total rudder area..	95 square feet
Total automatic rudder area	95 square feet
Engines (Wright Whirlwind J-5)..	2
Power at 1,800 r.p.m.	440 h.p.

Performance Data of the ZMC-2 Metal clad.

Gross lift (100% inflation with 92% pure helium at 60 deg. Fahr. and 29.92 in. Hg.	12,242 lbs.
Weight empty	9,115 lbs.
Useful load	3,127 lbs.
Crew (three)	600 lbs.
Fuel (200 Gal.)	1,200 lbs.
Oil (25 Gal.)	200 lbs.
Ballast (50 Gal.)	420 lbs.
Passengers and cargo	707 lbs.
Range with 250 Gal. (cruising speed)	760 miles
Maximum possible range (still air)	1,120 miles
Maximum speed as 440 h.p. ..	70 m.p.h.
Cruising speed at 220 h.p.	56 m.p.h.
Static ceiling	9,000 feet

The long life and performance of this ship have clearly demonstrated the soundness of the theories it involved and it has more than fulfilled every contract requirement. So, if debate is to follow the assumption that the metal clad airship is more suitable for helium than the fabric type we have been imitating, it is no more than just to show the basis for such a conclusion.

Fabric covered rigids consist of metallic frames, fabric cover, many gas cells of a rubberized fabric; so that in effect they had two skins—one to contain the lifting gas and the other to maintain the streamline form. In contrast to the metal clad this results in a tremendous waste of cubic space, with a corresponding loss of lift for any given area.

The cover of the metal clad acts as both a protection against the elements and a gas cell and the lift is distributed more efficiently for the full length of the ship. Measurement of the loss of helium during trial flights of the ZMC-2 showed that there was an average loss of about 200 cubic feet of helium in twenty-four hours. In lift this represents but twelve pounds loss and figured on an annual basis would mean the loss of 16 percent. of the total lift of the ship.

The engineers and other experts who built the ZMC-2 assert that in a large metal clad of commercial size this loss would greatly decrease for the following reasons. (1) The valves and accessories would be relatively lower in number and larger in size. (2) New material showing a much greater improvement over rubberized fabric in gas tightness may now be

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LOUISE THADEN, AIRWOMAN DELUXE

by HELEN WATERHOUSE

A glance above doesn't make one think at all of an aviatrix. Louise Thaden, in this story-loving pose, was snapped just after she returned from a record-breaking cross-country flight. M-m-m-m . . . have you, ah, er noticed what Mrs. Thaden is reading?

RUSHING through space in her streamlined blue plane, Mrs. Louise Thaden, plucky Bendix race winner, broke all previous flight records between Detroit and Akron on January 22.

The tall rangy Arkansas girl crossed Akron airport just 40 minutes and 43 seconds after leaving Detroit. That constituted an official record, which was later chalked up at the Bureau of Air Commerce in Washington as an inter-city championship, by Ray Brown, official of the National Aeronautical Association.

"'Wheels off and over the line,' is the timing rule," said Brown. "While Mrs. Thaden did not actually land on the port until almost three minutes later, the time of crossing the port is what counts."

The ship had accumulated such speed that it far overshot the port and came roaring back from the east with the thunder of an army bomber.

"I beat you by two minutes, Ray," called the smiling aviatrix, as she leaned from the cockpit. She was referring to an unofficial record made by Brown, who flew the General Tire and Rubber Co. "Miss Streamline," over the same course last November.

At that time Brown made the trip in 42 minutes, but there were no official checkers to record it.

Western Union officials with airport managers at both ends of the flight, acted as checkers with Brown on Mrs. Thaden's flight. "Western Union time is official time, therefore it was an official check," Brown further explained.

Two unofficial flights in the past have broken Mrs. Thaden's record—but both were in unlicensed experimental ships. One was by the late "Speed" Holman, the other by Major Jimmie Doolittle.

The girl who has constantly made air records, climbed nimbly from her ship to be greeted by a small crowd of spectators. Aside from the fact that her eyes were slightly bloodshot from the wind, she showed no effects of the speed at which she had traversed the air lanes.

"I hardly know I have been in the air at all," she laughed.

Bareheaded when she landed, she jammed a gray sports hat on her tousled locks.

Lighting one cigarette after another, she upbraided herself for so far overshooting the port.

"Gosh, I don't know what my top speed was," she said. "I was too busy up there. I flew at 5,000 feet all the way."

She scanned the lowering clouds. A few drops of rain were falling. "Doubt if I get off for Montreal tomorrow," she said cheerfully. From Montreal she was flying to the air show in New York City.

Brown figured that the girl flier had averaged 160 miles an hour over the 110 mile route.

"I just thought it would be fun to try to break your record," said Mrs. Thaden to Brown.

Later, curled up on a couch at the Brown home, for a well-earned rest, the plucky girl picked up a copy of POPULAR AVIATION and leafed through the pages.

"Things are definitely picking up in the air industry as this magazine indicates," she said. "In the last few months I have flown all over the country and I

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"....Clear and Unlimited"

by SWANEE TAYLOR

And now, our commentator writes a series of illuminative open letters, concerning this, that and the other which are instructive as well as interesting and entertaining.

THERE are several thoughts that occur this month which might best be handled by means of the "Open Letter" device; an old columnistic standby most acceptable to lazybones writers—or one who has just gone through ten exhausting days of National Aviation Show.

Our Commentator, Swanee Taylor.

The first is addressed to:

Gustave A. Parsons, Esq.,
Managing Director,
National Aviation Show,
New York, N. Y.

My dear Gus:—

Well, congratulations and felicitations certainly are in order! You did a superb job of jiggling the lead out of the Industry's trousers and staging the show you did. This department wishes to be among the first to bow low in admiration.

However, Gus, next year we are going to expect even greater things of you. You've demonstrated ability, vision and a rare brand of patience. Which means that from now on the Industry will lean heavily on you; such is the price of success!

If it means anything to you, my friend, be assured that this column will stand at your side to lend whatever aid that can be given. Count on me being with you as long as the supercilious National Air Race's attitude doesn't creep into any of your endeavors. Something I probably shouldn't bring up, because everybody knows that there isn't an ounce of haughtiness in your makeup.

Anyhow, good luck to you, and many thanks for everything.

* * *

Stanley Switlik, Esq.,
Switlik Parachute & Equip. Co.,
Trenton, N. J.

Dear Stan:—

Speaking as an old lighter-than-air man, I'd like to thank you for getting up the Cocoon Club in recognition of balloonists who had to jump for their lives. It's a pretty swell gesture which is deeply appreciated by all the misguided men who got hornswoggled into the balloon division during the war.

Of course you weren't manufacturing chutes in those days—more's the pity—nor were there very many balloon observers who went over the side. Nonethe-less, it is warming to know that somewhere in the world there abides someone who gives a merry hoot about the few poor souls who had to get from under a flaming sausage in a hurry.

And although I'm delighted that I don't rate one of your pretty Cocoon pins, I feel free in voicing the appreciation of balloonatics the world over for your thoughtfulness.

Let us pitch in and help *you* sometime.

* * *

The Air Lines Pilots,
In America.

Gentlemen:—

May I, as a frequent and regular passenger, call upon you to make some sort of concerted effort to recapture public confidence in air travel. It is up to you fellows to do it, and you fellows alone. Honestly it is!

Please understand me, I don't want to crowd in at this time with a lot of sage advice. Lordy no. I've been sorta running off at the mouth lately and there is a limit to how much one man should have to say. But I do want to tell you that the riding public, when it comes right down to it, *always depends on the pilot.*

It is a sacred trust indeed that these riders repose in your ability to think clearly and fly your trip like an honest pilot should. Each time a passenger climbs aboard your ship he knowingly, quite consciously, bundles all his hopes, his ambitions, his very life in a small package and hands it over to your safe-keeping. How can any man with guts in his stomach shrug cynically from beneath such heavy responsibility!

But that's not the point; no real guy is ever derelict in his ethical duties. And fortunately for flying most all of you fellows are honorable to the *nth* degree. But being honorable men, you must not fail to take the next, though somewhat painful, step. You've got to set up a procedure with which to carve from your midst any and all cancerous tendency toward carelessness, thoughtlessness and/or professional boredom.

Do it immediately, gentlemen, pray don't delay. Then, once the wheels are turning, shout loud for all to hear that the strictest code in history has been established; that every man among you has placed himself under a rigid self-discipline that would make the stoutest Spartan quail; that he who fails even for an instant will be driven from the sky like a dog by the rest of you.

When the world hears your proclamation, mark my words well, people will flock back to air transportation and airplanes will really start going places. Of course if some of you tough, blase birds think this is a bit boy-scoutish then, by the gods, it's boy scouts we need flying the air lines—not you!

May God bless you, gentlemen, and keep you from harm.

* * *

The Radio Manufacturers,
Of America.

Dear Sirs:—

Will you please tell a very curious public just why it is that you haven't gotten around to developing some first-class equipment for airplanes? Or have you?

The reason I ask (on behalf of aviation

And here is ole P.A.'s booth at the Air Show, supervised with great success by our friend Swanee.

enthusiasts everywhere), is because at a recent Washington "Inquiry" it was stated that the aircraft radio equipment on the market today lags far behind all other phases of aeronautical development.

What is the reason: Haven't you heard about man's oldest desire, the wish for wings? Or is it because you aren't familiar with the near-perfection of most aircraft currently in use?

I'll gladly print your replies.

* * *

The Publisher
Aero Digest,
New York, N. Y.

My dear Frank:—

What on earth is this I hear about you kicking up a ruckus against this publication before the Audit Bureau of Circulations? Is it true that you are yammering at that Supreme Court of circulation justice to have us taken from the "general magazines" classification and stuck down with "trade publications?" Don't make us be a trade paper, Frank,—we don't know how to play that game!

No, we don't understand your methods at all. Besides, through the years we've taken great pride that we managed to avoid being just another intra-Industry *Blowzy Bugle* bent on telling everybody what they already know by heart. What we did do, Frank, while you fellows were grabbing-off roughly $130,000 a year from the Industry—straight through the depression—was to carry the aeronautical banner out ahead into enemy territory and soften the sales resistance. You were too busy, then, bumbling about in bivouac like a top-sergeant with corns, to have any time for selling aviation to the public.

Knowing this, seeing how hard you were trying to run the Industry, we kept our editorial aim steady on the people who will support aviation (the buying public and the taxpayers), not at those who are supported by it. You don't hit the former class hardly at all, Frank, so why be dog-in-the-manger about us?

Another reason why, if you please, we'd like to stay out of the house-organ grouping is that in so doing we will not only be able to fight shy of journalistic mewling and disgustful log-rolling, but, too, we can maintain that political independence so hard-won by your forebears and mine. We, for instance, don't have to care what any President's son does as long as the President himself doesn't step out of bounds.

Frankly, Frank, I find it just short of impossible to believe that you'd kick over your pot in A.B.C. chambers on account of us. For, in your own trade-papers recapitulation, called I believe, "The Truth About Aviation Advertising," you sweetly left POPULAR AVIATION out of the snug little gathering.

By golly, you know, I'm beginning to believe that somebody has been bearing false witness, Frank.

Now I'm wondering why I wrote this letter!

Good-bye, Frank.

* * *

And so to bed, with a pair of more than ordinarily hot dogs after a most successful show week. A swell show is always productive of physical lassitude.

An Old Umbrella Type Helicopter

by FLOYD LOGAN

And here she is—more than a foot off the ground. A real achievement for a helicopter of any type.

OUT ON the nine-mile road, east of Detroit, a barn-door slowly opened and emerging from the mysterious depths therein, a flying creation such as never witnessed before was rolled out in the barnyard.

There it stood, motor idling—wingless, a challenge to aeronautical engineers the world over. For this "Umbrella plane" (commonly dubbed, by its inventor) would take-off straight up, like a jack-in-the box. Straight up, off of a dime or a postage stamp, if you like.

I will not delve into the technicalities of this amazing flying contraption, but will try and point out briefly the principle employed in its main feature which was, naturally, the umbrella propeller.

A small group of engineers, inventors and news men stood gaping at this "Ugly Duckling of Aviation," and then Test Pilot Jack Davis, who was responsible for its design and proving, stepped into our small circle, ready to give us the low-down on his experiments with this fantastic Flying Machine, as it were, and then prove his contention by actually flying the thing.

Jack explained that on his first model he had found the possibilities of several novel and distinct means of committing suicide in his attempts to fly the umbrella. But one by one, over a period of many months of study, experiments and expense, he had gradually ironed them out until he had it perfected so that it would flit, and any young bird must flit before it can fly, of course. Then he called our attention to the umbrella propeller, which looked like a coolie's hat.

For example, let us take an ordinary umbrella frame without the covering. Now let us shingle each rib with metal hinged shingles that, when they are extended laterally, will extend to the next rib. And so on, around the complete circle.

When not in motion all these overlapping "shingles" or valves, will dip down vertically from their own weight. That is natural. Straight up and down on dead center. Now let us revolve the umbrella around like a top spins. The air resistance, striking the hinged blades, would tend to throw them off of dead center on an angle, depending upon the revolving speed.

Now say we jerk this spinning umbrel-

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Just before the battle, mother! The more-than-ordinarily-brave-pilot is pulling himself together before the ordeal.

The NATIONAL AIR BOARD Says—Unbiased Opinion to Further National Aeronautics

MEMBERS OF THE BOARD

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A. Raymond Brooks
Ray W. Brown
Reed M. Chambers
Richard H. Depew, Jr.
William C. Fleming
Betty Huyler Gillies
Randolph F. Hall
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James B. Taylor, Jr.
D. W. Tomlinson
Grover Whalen
E. Burke Wilford
R. C. Wood (Paris)

ALEXANDER KLEMIN, CHAIRMAN

THE ninth meeting of the Air Board was exceptionally well attended and members were glad to welcome as guests Mr. Paul Thomas of Philadelphia, General Director of the Air Defense League, an organization which is rendering splendid service by fostering public and congressional interest in our air forces, and J. B. Rathbun, Managing Editor of POPULAR AVIATION.

These gentlemen did not participate in voting but joined the discussion in the most helpful fashion. It was rather a curious experience for the Editor to be present at deliberations which his magazine reports month by month, but which he cannot and does not wish to influence in the slightest degree.

The Board was also fortunate in having its meeting coincide with the National Aviation Show, which has been so successful and so splendidly attended, because this brought two out-of-town members to the meeting. Thus, T. W. Tomlinson of altitude flying fame was able to give members a first-hand account of his remarkable experimental flights in the sub stratosphere.

There is nothing better calculated to further the conquest of the stratosphere than Mr. Tomlinson's experiments. Involving as they do flights at altitudes in the neighborhood of 30,000 feet and the use of oxygen over periods of an hour and a half or more, these experiments are not without serious elements of danger but they are giving American aviation reliable, systematic, far-reaching information on the possibilities of altitude flight.

Ray W. Brown, another out-of-town member, has the distinction of having flown over 1700 hours in the ordinary course of business, with the radio direction finder constantly employed to solve his navigational problems. The Board felt that its discussions were greatly strengthened by the presence of these two men who are in the very forefront of practical aviation.

A DISCUSSION OF THE AIR COMMERCE BUREAU

Our readers will remember that at its previous meeting, the Board devoted a good deal of its attention to the question of the recent accidents and came to the conclusion that to no one cause and to no one group of men could the cause of these accidents be atributed. Certainly it would be most unfair to imply that the Air Commerce Bureau is alone or even to any large extent to blame for such accidents. Yet the feeling persists and the discussion only emphasized the feeling that the organization of the Air Commerce Bureau could be vastly improved.

There are some splendid men in the Air Commerce Bureau. Major R. W. Schroeder, among others, has earned glowing encomiums from the air lines and the aviation industry as a whole. His fine experience as a flier, test engineer and operator, and his real ability are enabling him to do excellent work in the Bureau. There are other men working with no doubt equal merit. But the Air Commerce Bureau suffers under two handicaps.

C. S. (Casey) Jones, is a prominent and active member on the National Air Board.

In appointments and promotion, the Bureau is not, as a whole, under Civil Service rules and political implications cannot be avoided. It is only when men in government departments are under Civil Service rules, with assurance of permanent positions and a well-defined plan of promotion that the best men are encouraged to enter and remain in governmental service in spite of the relatively lower salaries.

The other handicap is that the Air Commerce Bureau is no longer under the guidance of an Assistant Secretary of Commerce, (with all the prestige of such an office) whose sole duties are the guidance of the aeronautical activities of this Department.

It will be remembered that soon after the passage of the Air Navigation Act, a splendid trio of young men were appointed as Assistant Secretaries for Aeronautics in the War, Navy and Commerce Departments respectively. It will be remembered also that the first incumbent of the post in the Department of Commerce was William P. MacCracken, Jr., known to thousands of aviation men as Bill. Nor is it yet forgotten what a splendid job Bill MacCracken and his successor Clarence Young did in the pioneer organization and conduct of Air Commerce. How, why and when Assistant Secretaries for Aeronautics disappeared from the scene is not quite clear.

It is also perfectly clear that no matter how hard Colonel Johnston, Assistant Commerce Secretary, may work he has a multiplicity of duties other than aviation to attend to, and his previous experience, extended and distinguished as it may be, has *not* been of an eminently aeronautical character. Yet the Air Commerce Bureau has under its care the annual expenditure of funds exceeding the annual expenditures of any one or even two airlines and a task of national importance to perform.

After long, earnest, and unbiased discussion the meeting came to the conclusion that it was both its duty and its privilege to address a recommendation to the President for possible remedy of these two difficulties. No doubt readers will have already noted through the daily press the letter addressed to the President by the Board, yet for the record, this letter is reproduced in full here:

A Letter to the President

The Honorable Franklin D. Roosevelt, The White House, Washington, D. C., Dear Mr. President,

The sole purposes of the Air Board, composed of men well versed in matters aeronautical, is the frank discussion of American aviation and the expression of unbiased opinion regarding its problems.

At its two recent meetings the Air Board has given the most careful

thought to the series of disastrous accidents which have marred the splendid safety record of our airlines and has come to the conclusion that no one physical cause, and no one group or organization can be made to appear as the sole cause of these accidents.

A most important element in the development and safety of American flying, particularly in regard to scheduled Air Transport, lies of course in the Air Commerce Bureau which undertakes the vital duties of regulation and maintenance of aids to aerial navigation.

Whatever may have been the cause of these accidents, there is no doubt that efficiency in the conduct of the Air Commerce Bureau, however efficient this Bureau may be now, should be always maintained and if possible increased.

I have been asked by the Air Board, after its most careful deliberation and unanimous vote to transmit to you, in the most respectful and sincere spirit the following suggestion as calculated to increase the usefulness and value of the Air Commerce Bureau:

That an Assistant Secretary of Commerce be appointed whose sole duties should be in the guidance of this Bureau. Such a man should be a flier, a man of personality and established reputation in aviation, and one in whom the entire nation could repose implicit confidence.

Nothing in the opinion of the Air Board would be so well designed to increase the morale of Air Commerce, and nothing would better serve to renew the confidence of the public in the safety and good conduct of our airlines. It may not be amiss to point out that at the organization of aeronautical activities of the Department of Commerce, an Assistant Secretary was appointed and that under his guidance the maximum efficiency, the utmost friendliness with industry and the greatest public confidence in the work of the Department prevailed. There is therefore ample precedent for such an appointment.

The Air Board appreciates your kindly and well informed interest in the progress of American aviation and feels sure that this well meant suggestion will have your friendly consideration.

I am, Dear Mr. President,
Respectfully yours,
Chairman, Air Board.

AN AVIATION TROPHY FOR YOUNG AMERICANS

Quite recently the publishers of POPULAR AVIATION have generously expressed themselves as willing to present annually a trophy or prize to honor some achievement in aviation, the trophy or prize to be awarded by the Air Board.

This offer was examined in the light of the following questions:

1. Is an additional aviation trophy or other distinction needed?

(*Continued on page 60*)

THE POGUE CARBURETER—YES OR NO?

by EDWARD GREEN

IF THE claims of Charles Nelson Pogue and his associates are substantiated by proven tests, aviation will take great steps forward. One of the greatest problems of all will have been solved; that of carrying a minimum of fuel in proportion to payload.

Pogue, a Canadian, has startled conservative financiers and all of the prominent motor manufacturers by devising a carbureter which is said to deliver 200 miles to the gallon. Several engineers, representing large interests, have driven Pogue's test car and reported 28.6 miles to a single pint of gasoline.

The engineers have confessed themselves unable to offer a reasonable explanation. They emphatically state that such mileage is impossible and when they have driven the car they shake their heads and are still unconvinced. They make no charges, however, nor even hint of trickery.

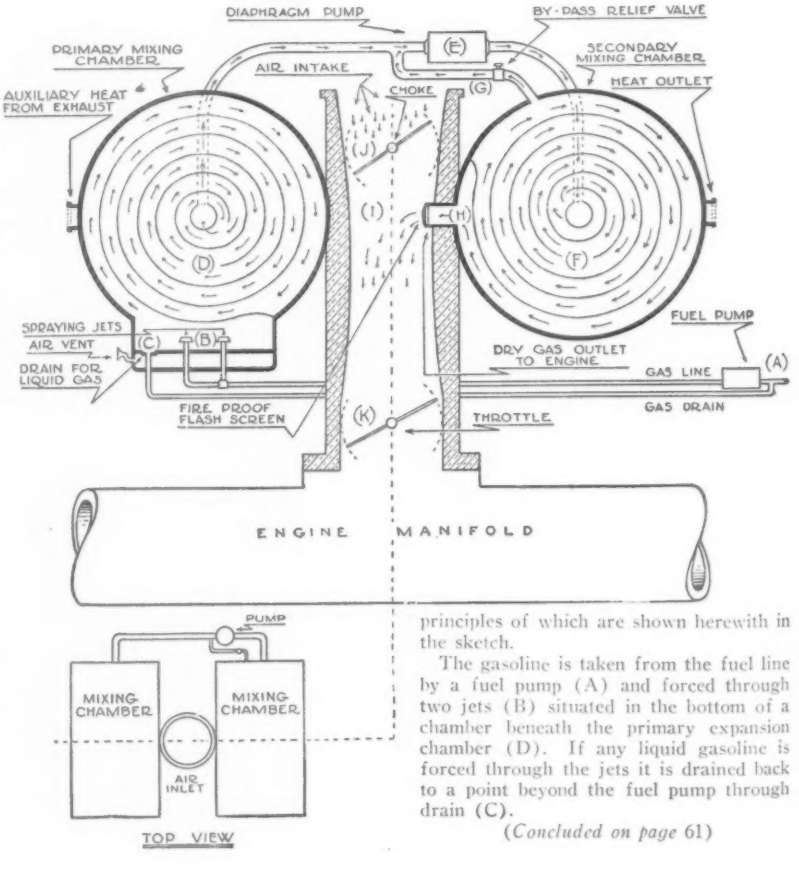
Today, Pogue's invention is known as the "Mystery Carbureter." Editors the length and breadth of the continent are commenting on it. All of them are chary of accepting Pogue's claims on the grounds that they have never seen the device.

It is entirely possible they would know no more about it if they had one set in their laps for if ever an invention resembled something different from what it is intended to be, Pogue's carbureter stands in a class by itself.

It was this writer's good fortune to "break" the Pogue story and give it to the newspapers and trade journals. For many months, even years, Pogue's experiments were shrouded in secrecy and aside from a few rumors, nothing tangible leaked out. The wildest tales were circulated describing the carbureter. Its effect on present-day motors and other ridiculous yarns. Even today, many distorted versions of the invention appear in irresponsible publications so for the benefit of the many readers of POPULAR AVIATION the actual working principles of this carbureter will be described.

Pogue contends that present-day carburetors do not permit gasoline vapor the fullest possible expansion. What the layman choose to term as "spray" in present devices is nothing more than tiny globules of pure gasoline as the mixture rushes through the jets too swiftly to vaporize properly. As each globule is pure liquid gasoline, the vapor surrounding it is the only part that can burn.

Each of these globules would, if fully expanded, produce anywhere from ten to twenty times its own volume of gas. Pogue therefore reasons that if he can break up these globules he will secure ten to twenty times the amount of power from the same quantity of gasoline. In order to do this he has designed a carbureter, the working principles of which are shown herewith in the sketch.



The gasoline is taken from the fuel line by a fuel pump (A) and forced through two jets (B) situated in the bottom of a chamber beneath the primary expansion chamber (D). If any liquid gasoline is forced through the jets it is drained back to a point beyond the fuel pump through drain (C).

(*Concluded on page 61*)

Sky-Rocketing Through Space

by ALVIN EDWARD MOORE

(Part III)

Rockets—especially those which are ultimately intended to transport mail and passengers—are a rare source of interest to the air-minded. Mr. Moore's authoritative articles in previous issues of this magazine have been immensely interesting to the air-minded reader. This is article No. 3.

WHEN Fritz von Opel, wealthy young sportsman and automobile manufacturer, flew the first rocket-plane driven by powder rockets, Max Valier, who had interested von Opel in the rocket ship, was working hard on his experiments with liquid fuel rockets.

All that fall and winter Valier continued his experiments, working in cooperation with Dr. Paul Heylandt in making a light, liquid-fuel motor. Then, with the spring, they felt they had solved the problem fairly well.

Valier installed one of the liquid-fuel rocket motors, whose development was due mainly to Dr. Heylandt, in a small streamlined racing car. Its only instruments and driving elements—other than the simple rocket motor—were the steering wheel, the brakes, a gas control pedal and two gauges for measuring the pressure of the liquid oxygen and methylated spirts which, with water, formed the fuel.

On April 17th, 1930, Valier made a semi-private test of the new car on a flying field. He opened the valves and a stream of gas escaped from the rear tube and began to burn. The flame shot out until it was four feet or more in length.

Max Valier sat in the driver's seat—a young man, thirty-five years old, enthusiastic in this pioneer work of man that he had assigned himself.

He released the brakes. There was a great noise and the car shot forward. Its speed rose to 60 miles an hour. Twice he circled the flying field and then he put on the brakes and stopped abruptly.

Max Valier was happy. The first liquid-fuel rocket car had worked as well as he had hoped. It operated well and cheaply—hundreds of times more cheaply than the powder rockets. And it was safer too—yes, perhaps; but still it was dangerous.

There were many details yet to be worked out. The rear tube for instance should be improved and the oxygen container. . . . But he and Dr. Heylandt were on the right trail—the trail of the stratosphere plane and the space ship of the future. . . . Berlin to New York in two hours. . . . He would make some more experiments, and try the car again.

One month and one day later—on May 18th, 1930—Max Valier and some helpers were installing an improved Heylandt rocket motor in the car. Interested, oblivious to the danger of the rocket fuel Valier was standing behind the car, near the exhaust tube. He was testing the pressure of the new fuel container.

Suddenly there was a tremendous explosion. A jet of flame leaped toward Max Valier. It shot out ten feet, and wrapped around this man who had sought to control it. Twenty feet from the car Max Valier was hurled. He came down unconscious and died soon after.

Thus perished Max Valier, one of the most enthusiastic, able and daring of the early rocket craft pioneers. Four times he had driven pioneer rocket cars—twice, using powder rockets, at more than one hundred and ten miles an hour and once at one hundred and thirty-one miles an hour; and he had driven the first liquid-fuel rocket car at sixty miles an hour, and the first rocket-propelled ice sled at 235 miles an hour.

Test rockets are fired from this 60-foot tower in New Mexico.

Rocket flights are controlled from this cabin which is nothing more than a sand-bagged shelter.

He had interested Fritz von Opel and through him Freiedrich Sander in rocket propulsion. He had labored hard and dared all to make the western world see the future value of this dangerous thing that man was trying to master. And now, at thirty-five, he was dead from an accident.

He had been a brave man—like all pioneers a little rash—but courageous. He rushed in, took hold of the flaming giant man needed, and said: "See. It is easy. Come let us not experiment so much. Life is short. Let us have action. There must be a beginning—so—here goes." And he rode the flaming giant; and it took his life because he hadn't waited with the cautious ones for asbestos protectors.

And so Max Valier, not so lucky as Fritz von Opel, took the long ride. But the idea of the human race for which he had lived his short but useful life did not die.

Just a little before his death, conservative scientific leaders of France—leaders in astronomy, physics, engineering and mechanics, were seriously talking among themselves of the distinct possibility of a trip to the moon in the next fifteen years. On May 7th, Robert Esnault-Pelterie the famous French engineer and inventor had made a talk to these leaders of Paris, based on his laboriously and carefully written treatise on rocket propulsion and the navigation of space.

"It would first be necessary to construct rockets with registering instruments," he said, "which would be sent empty to a height of fifty thousand to seventy thousand meters. Afterward ascension would be made with a crew aboard.

"At the start the pilot would fly almost parallel to the earth by the use of small wings. Then as he proceeded he would direct the rocket more and more toward the vertical until he attained the equivalent of actually falling through space.

"The distance of these attempts would be gradually lengthened, and in fifteen years time I feel confident it would be entirely possible to make a voyage around the moon and return.

"Whether such efforts will immediately be made seems doubtful, for it will be necessary first to find a financial backer. But I feel certain that the method will be applied very soon to practical transportation on our own earth. It will be a comparatively short time before a trip from Paris to New York can be made in twenty-four minutes and a trip around the world in an hour and a half."

The distinguished scientists present did not regard the talk as visionary, but talked

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and argued among themselves about the details of space flights.

The very roughest part of man's pioneering through the unknown wilderness with the rocket ship thus was over. The conservative ones, in principle at least, were beginning to concede that the journey was not ridiculous, but possible. The way ahead was still rough and dangerous. But those brave pioneers who traveled it would not have to go so much alone.

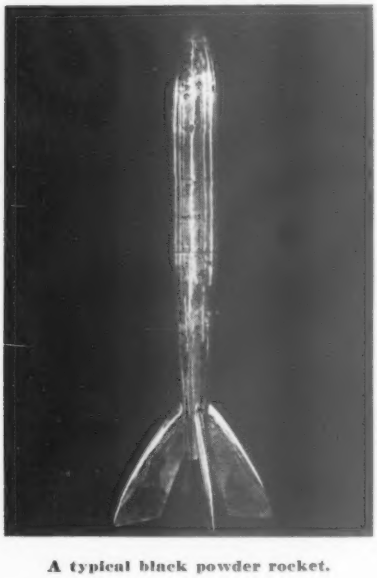
A race now began between pioneers of the rocket in various countries for the honor of first sending a rocket into the stratosphere.

In Germany, the scientist Oberth, the inventor Max Valier, the novelist Otto Gail and others had organized the German Interplanetary Society which now had almost a thousand members, including many of the foremost German scientists; and in France there was a similar society; and before Valier's death, in 1930, the American Interplanetary Society was formed; and in Russia scientists were beginning to turn their attention to rocket propulsion.

That autumn of 1930, after Valier's death, the German Interplanetary Society bought some land near Berlin and made the first rocket flying field. Here they began to experiment with liquid-fuel rockets. Six engineers were hired, and they often worked seven days a week on the many problems before them. They made a proving-stand, and built embankments nearby, behind which the workers could stand in safety while the rockets were tested in the stand.

The fuels were admitted to the rocket combustion chambers by control from the embankments, and the force of the motor in operation was recorded by automatic indicators. The young and dangerous rocket would not snuff out the lives of these careful experimentors, as it had the life of Valier.

On March 13th, 1931, Karl Poggensee an aeronautical engineer of Germany, sent an instrument-carrying rocket up 1500 feet, and it safely landed by parachute.



A typical black powder rocket.

A glider rocket with wings. The wings extend automatically for a glide when the rocket charge is exhausted.

The following day Johannes Winkler, President of the German Interplanetary Society sent one up a thousand feet, without damage to its instruments.

On April 15th, 1931, Reinhold Tiling, a rocket enthusiast who has been granted patents in a number of nations, tested a number of rockets of the type he had invented. Instead of the parachute for breaking the fall of the rocket back to earth Tiling had mounted hinged autogyro blades near the nose of the rockets which he thought would work on the principle of the autogyro to lower slowly the rocket and instruments.

One of the rockets exploded at about 500 feet, but five rose more than a mile and returned to earth sustained by their rotating autogyro blades.

At the rocket flying field near Berlin, the engineers had learned from their experiments with miniature rockets that an egg-shaped combustion chamber was better than either a conical or a cylindrical chamber. Into the egg-shaped chamber the two liquid fuels (usually gasoline and oxygen) were admitted near the outlet from the chamber into the flaring exhaust tube. At this part of the chamber the fuels were sucked in, and apparently they were carried up along the walls of the chamber to unite and fire at its top.

The burning gases seemed to create this suction only near the outlet from the chamber, for at the top of the chamber the entrance of the fuel was resisted by the great pressure of the explosion.

The oxygen was pumped to the inlet by the pressure of its vapor forming above the level of the liquid in its container near the nose of the rocket. There was a safety valve to allow the escape of vapors under dangerous pressure. The gasoline was pumped by nitrogen under pressure.

The success of the first liquid-fuel rockets sent up by Robert Goddard of America, in 1926 and 1929, and an active interest in his experiments by Charles Lindbergh, the famous American aviator, led to a grant of $100,000 from the Guggenheim Memorial Foundation for further experiments by Goddard.

Goddard chose Eastern New Mexico, with its dry clear air, relative freedom from storms and fairly level country, as the site for his rocket experimental field. In 1930 a shop was built at Roswell, New Mexico, and machines were installed in it for making rockets. Nearby, a twenty-foot tower for measuring the lifting force of rockets was built.

Fifteen miles out over the barren, lonesome plain a sixty foot tower was erected for launching rockets. A thousand feet from this large tower a shelter covered with sandbags was built, and to it from the tower ran electric wires for firing the rockets, and close to the tower a concrete dug-out was built in which an observer of the flight could take shelter.

Here in New Mexico, Goddard and his associates experimented extensively, concerned mainly with the problems of stability of the rocket in flight and the combustion chamber and fuel-pumping means in the rocket motor.

Fixed air vanes they learned were not satisfactory to hold the rocket on its course, as the load of fuel made necessary so small an acceleration at the beginning of the flight that the stream of air did not exert enough pressure on the vanes.

The pendulum stabilizer on the other hand would not function well when the acceleration became large in the upper air. The gyroscope was determined to be the best form of stabilizer; and in 1935 a number of fairly successful flights were made of rockets stabilized by gyroscopes.

A powerful rocket motor that was very light and long-lived was developed.

In Goddard's much-publicized patent No. 1,809,271, for which application was filed in 1929, he proposed the use of gas turbines operated by the gas from a rocket motor to turn an airscrew until the rocket ship

(*Concluded on page 62*)

Notes on Propeller Pitch Angles

by
RAOUL J. HOFFMAN
Aeronautical Engineer

THE pitch of a propeller is a function of power, revolutions, flying speed, diameter and blade design.

The maker of a propeller, after having decided on the diameter is mostly interested in the geometrical or nominal pitch of the propeller, which is the advance per turn of the slope of the flat side at the distance ¾ of its radius.

Knowing the pitch and the diameter, one can produce a very satisfactory propeller of the same family; propellers that have similar blade layouts.

Mathematically the pitch of a propeller is the distance from the axis times 6.283 (2π) times tanA; A the angle of the section with the plane of rotation. In case an exact result is not needed, and the angle is not over 15 degrees an empirical formula will suffice.

Pitch equals .111 times the distance from the center of axis times the number of degrees. Applying the formula above to slopes up to 20 degrees the actual pitch will be 3% higher than the one estimated.

The pitch/diameter ratio is a function of the propeller advance/diameter ratio and may be expressed in following approximate formula:

$$P/D = \frac{88\ \text{M.P.H.}}{\text{R.P.M.} \times \text{Dia.}} + .08$$ and from this we find:

$$\text{Pitch} = \frac{88\ \text{M.P.H.}}{\text{R.P.M.}} + .08\ \text{Dia.}$$

with maximum blade with of 8.3% of the diameter; pitch and diameter expressed in feet.

Measuring the angle of any blade section for finding the pitch is a simple matter if the surface is not convex; usually at least half of the lower surface is flat.

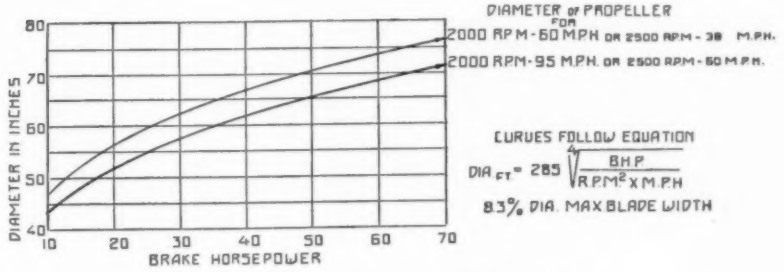
Various methods are employed to find the angle. Measuring the angle of a wooden propeller the face of the hub is leveled and the angle measured with a protractor directly or indirectly with scales; later method gives you only the slope. The larger the instrument the more accurate the reading.

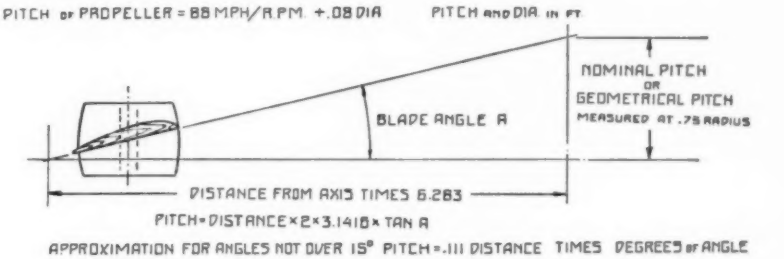
The adjustable metal propeller is usually set on a special built table with a set of tapers to fit any standard hub and with a marking indicating the forty-two-inch distance.

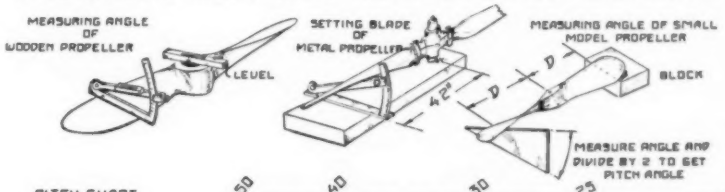
This distance is an accepted norm at which the angle is given for setting. Set the protractor at the angle required and adjust blades until both are parallel with the indicator.

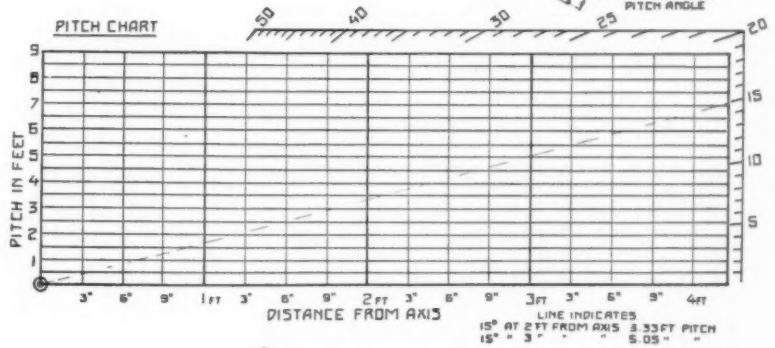
To measure the angle of a small airplane model propeller a small block is used; the propeller is pressed down slightly and the angle measured at equidistance (D); to get the pitch angle the measured angle is divided by two.

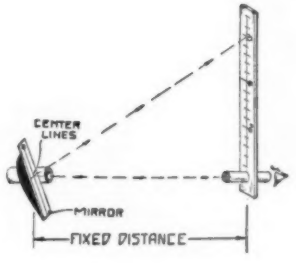
Another method of measuring the pitch of a propeller is the optic method. Placing a narrow mirror on the blade and and sighting thru an eyepiece, which is aligned with the two center lines, the reflected angle is seen in the mirror; then turning the propeller on its axis and repeating above operation their angles can be compared to their identity.

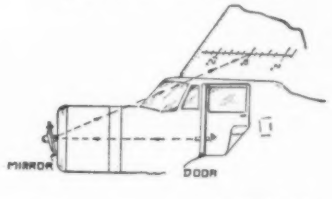



PITCH OF PROPELLER = 88 MPH/R.P.M. +.08 DIA
PITCH AND DIA. IN FT.
NOMINAL PITCH OR GEOMETRICAL PITCH MEASURED AT .75 RADIUS
BLADE ANGLE A
DISTANCE FROM AXIS TIMES 6.283
PITCH = DISTANCE × 2 × 3.1416 × TAN A
APPROXIMATION FOR ANGLES NOT OVER 15° PITCH = .111 DISTANCE TIMES DEGREES OF ANGLE









This system can be utilized in a manner shown in the sketch by fastening the eyepiece in the door and printing the angles on the lower wing surface; then in case of a forced landing without taking off the propeller the blades may be set to a lower pitch for a quick take-off.

There are numerous other instruments for measuring the angle of a propeller blade; some of them have double protractors, one is set for the ground angle of the motor axis and the other is used to measure the additional slope of the blade.

The distance, the angle and the pitch are in direct correlation; plotted graphically they will form a pitch chart as shown. The horizontal lines are the pitch lines, the vertical lines are distances from the axis and their intersections connected with the zero point indicate the slopes in degrees. Therefore knowing two factors we can always find the third one.

Special pitch charts are kept for reference or manufacture if the pitch varies along the radius; this variation is marked by a curve on the chart.

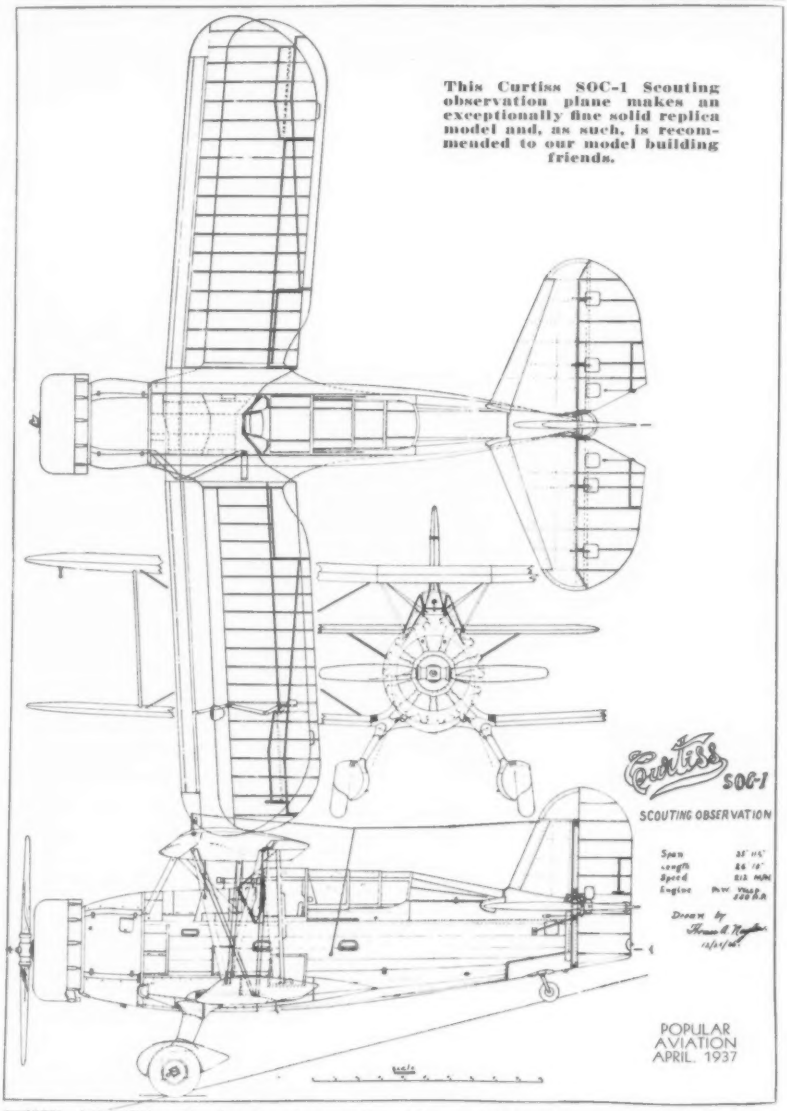
Mounting the pitch chart and attaching a pendulum to it we have a pitchmeter as shown. This will make direct reading of the pitch possible. If the propeller is on the airplane and the angles are measured on both blades without turning the propeller then, to get the pitch angle, the blade angles are added and divided by two; if it is necessary to reverse the instrument the angles are to be subtracted from each other. The difference between the blade angle and the pitch angle is the ground angle of the motor.

Let's say, for example, that we found—placing the propeller horizontally — the two angles to be 25 and 5 degrees. Then, $(25-5)/2=15$, 15 degrees is the blade angle and $25-15=10$, 10 degrees is the ground angle.

This data is of particular interest and importance to amateurs and home-builders who wish to make their own propellers or who wish to run conclusive tests on their ships. It is a simple instrument to make and to use, and can be quickly built for this purpose with sufficient accuracy.

This is the method of using the propeller pitch angle protractor.

Scale Drawings of the Curtiss Type SOC-1


This Curtiss SOC-1 Scouting observation plane makes an exceptionally fine solid replica model and, as such, is recommended to our model building friends.
Curtiss SOC-1
SCOUTING OBSERVATION
POPULAR AVIATION APRIL, 1937

THE ABOVE scale drawing is a welcome addition to the files of photo and drawing collectors as well as to the many solid model builders who read POPULAR AVIATION. The plane has an exceptionally high speed for its power and has proved to be one of the best biplanes of its class now in service for scouting and observation missions. Next month we will publish another drawing.

The French Government Assists Amateur Activities

GOVERNMENT assistance in the development of private aviation in France is to be considerably expanded during 1937, a report to the Commerce Department from its Paris Office revealed this month.

Official encouragement to private flying in France during 1936, it is pointed out, took the form of bonus payments on purchases by individuals of various types of tourist planes. A decree issued in August abrogated the bonus plan and substituted a system of credits to be granted for "popular aviation in France."

The government program, which includes intensive theoretical and practical instruction for young men will be carried on through the various aeronautical clubs. Such clubs number aproximately 180 and have a total of 150,000 members with 1,300 planes, owned by individuals or groups.

According to the Government plan, clubs participating in the popular aviation program will be supplied with planes without cost and credits will be allotted for the upkeep of flying equipment and the training of students. This is something that should be done in this country.

XUM

Airlines Adopt Homing Devices

by MAX KARANT

With much ridicule being centered on the Bureau of Air Commerce's admittedly faulty radio beam equipment, the airlines of the nation now have turned to the perfection and adoption of what promises to be a major advancement in safety in bad-weather flying.

BAD weather always has been and probably always will be the biggest millstone around aviation's neck. It was in the days of Calbraith Rogers. It was in the days of Knute Rockne. It still was just recently in a demoralizing series of airline crashes that cost the lives of a score of humans, among them Martin Johnson, the famed explorer.

Basically, bad weather has been responsible for a majority of aeronautical disasters—bad weather and the ever-present human element, that is. But, as the years progress, each particular element that once killed people in the air is being eliminated bit by bit. Where iced-up wings and controls once claimed a number of lives, de-icers have made that peril an every-day occurrence which has been reduced to almost a mere nuisance.

The artificial horizon, radio beams, automatic pilots, perfected two-way radio—all have helped eliminate or at least lessen to a remarkable degree the inherent dangers of aviation.

Although not an entirely new device, the radio homing compass just is beginning to come to the fore as several prominent American airlines announce the results of extensive experiments with that device. Transcontinental and Western Air, Inc., is installing a homing compass of its own design on its Douglas airliners. As this goes to press, several TWA airliners are flying that line's routes with the aid of the new direction finders.

Meanwhile, United Airlines feels that its experiments with its particular homing devices are not yet complete. And American Airlines still is proceeding carefully in that field.

Ray W. Brown, tire company executive and an aeronautical authority, has used the homing compass in his company's ship for more than 1,000 hours.

United Airlines experimented with anti-snow and anti-rain static-eliminating antennas for many months and finally pronounced the above loop antenna its most successful to date. All United Airliners soon will be equipped with this advanced equipment.

The radio homing compass is not exactly a new discovery with U.S. airlines. Perhaps the first the American public heard of that device was when Gerard Kreusi patented his homing device a few years ago. Quick to follow in Kreusi's tracks were several others, earliest among which were produced by William Lear and the Radio Corporation of America.

Since then, several different designers and imitators have gone into production on homing devices. TWA, however, devoted much of its experimenting to its own version of the homing compass. That line spent reported $25,000 just for one part of the homing direction finder—an anti-static loop antenna. United Airlines built four different types of anti-rain and anti-snow antennas during the past ten months and still is testing these devices on a special laboratory airliner set aside for experimental purposes.

With TWA's homing direction finder already in the field in airline operations, that device can be used as a descriptive example of what this new type of instrument means to additional safety in bad weather operations.

The TWA anti-static antenna is located on the underside of the fuselage near the nose of the airliner. The antenna can be turned in any direction by the pilot from inside the control cabin. In this way the pilot can ascertain from what direction radio signals are coming by the signals' intensity or weakness. The ability to learn this almost instantly in mid-air is one of the major points around which the new homing device is based.

TWA's homing direction finder, then, works something like this:

Suppose an airliner is flying blind at night and static due to bad weather drowns out radio beam signals. When it becomes impossible to make out the beam at all, the pilot (and consequently his ship) becomes lost. Just a few years ago that would have meant almost certain death.

Now, however, the pilot switches on his homing compass. He is flying at 10,000 feet, blind, and the de-icers are methodically cracking off rapidly forming ice. Snow static still cuts out the beam's audibility over the conventional trailing antenna. But the homing plays its most important role in conditions like this.

In the cockpit the pilot slowly turns a handle in his cabin until a needle on the dial before him rests at 90 degrees. Under the cockpit floor the anti-static loop on the plane's underside has turned with the needle on the dial and the loop now is parallel with the plane's line of flight.

At this position the antenna receives the maximum strength of signals from stations either ahead or behind. This, of course, applies to any radio station within the scope of the new instrument.

Now, say that our lost pilot happens to be somewhere between Milwaukee and Chicago. He wants to get to Chicago.

XUM

First he tunes on the Chicago station's frequency. He then sets the needle on the instrument's dial at zero. At this position the loop antenna beneath the ship is at right angles to the plane's line of flight.

Next, he turns the airplane until he obtains the *minimum* signal strength from the Chicago station. Then he sets his directional gyro at zero so that the directional reading and signal volume reading check to within one degree.

The pilot then swings the ship 90 degrees to the left and flies in that direction for three minutes. Then he banks right to the original zero reading on the directional gyro and, holding this course, takes a new bearing on the broadcasting station by rotating the loop antenna. By checking the new bearing on the station, the pilot then returns the loop to its original zero position, sets his directional gyro on the homing device's final reading and flies directly to the station.

TWA's device, though by no means a new idea, is one of the first to be put into actual commercial operation. United has, to date, limited its activity with this particular equipment to the use of the antistatic loop antenna. That line is devoting much of its experimental efforts to the perfection of a blind landing system with which it has been experimenting for many months at Oakland, Cal. In contrast to TWA's most efficient point of operation of the movable loop antenna, United engineers found their particular antenna performed best when mounted directly on the nose of the ship.

Though the airline homing compass is an innovation to the lines' particular operations, other pilots in the United States have been using somewhat the same type of instrument for some time with marked

(*Concluded on page* 70)

Snow and rain static is eliminated to a great extent in radio beam reception by TWA's newest anti-static loop antenna shown above. This line and others, who have been experimenting, already have adopted equipment based on this principle.

WINTER SPORT—PROP AND ALL

Here, dear reader, is the last word in animated ice skates. This ingenious Parisian engineer has hooked up a steering gear, engine and propeller to his ice skates and, well, there you are. Another feature to this gadget is that the ice skates can be removed in summer time and pontoons substituted for water travel.

WHILE the average person has been content to ice-skate in the good old-fashioned manner, Engineer Jaffre of Paris, France, hasn't. To give the revered old winter sport a "shot in the arm," so to speak, Engineer Jaffre has rigged up two wide skates to a steel tubular frame that is complete to engine, gas tank, seat and airplane propeller.

This particular engine is said to turn up 5,000 revolutions per minute and—according to Inventor Jaffre—can "skate" down the ice at 25 miles an hour. Of course in summer when pontoons are attached, the going is not so fast—but it's fun, the inventor says. And this is supposed to be easier to build at home than is Dick Cole's similar device shown on page 42 of this issue. Possibly one horsepower will be sufficient for experiments.

The $3,000,000 "Joy-Stick" Lawsuit

SHUTTLING back and forth, between the Courts of the United States, the case of Robert Esnault-Pelterie against the U. S. Government is still hanging fire. Mr. Pelterie, inventor and a resident of the French Republic, awaits final decision on a $3,000,000 lawsuit.

The "amended complaint alleges a cause of action under the Act of June 25, 1910, as amended, for the use and manufacture by or for the United States of a device covered by his patent No. 1,115,795, dated November 3, 1914, which describes means for the control of the equilibrium of airplanes by the simple oscillation of a single lever moving in all directions and operated by one hand."

Mr. Pelterie's original idea seems to have included the use of two joy sticks in the controlling mechanism of the plane, and the patent applied for lingered in the United States Patent Office for a period of several years. Meanwhile, however, the patent was amended to have general control by a single lever or stick and that came into universal use during the time the patent was still in the Patent Office. The claim in the case was amended to cover the wide-spread use of it at that time.

Not only did Mr. Pelterie bring suit against the United States Government, for its real or fancied infringement on his invention, but he also charged the Chance Vought Aircraft Corporation for like encroachment. The case against Chance Vought was first tried in the Circuit Court and thence appealed to the Circuit Court of Appeals, but the Chance Vought won in both instances.

Meanwhile, in the suit against the U. S. Government the findings were found to be incomplete. Accordingly, the Government apparently lost suit in the Court of Claims. Due to the still unsettled conditions, no broad statement is yet available.

However, the case was appealed to the Supreme Court for its October sitting, and was remanded back to the Court of Claims to find out whether the patent was valid and if valid whether it was infringed upon by the United States Government. To this writing, the Court of Claims has made no specific findings.

Quoting from bulletin No. 41, dealing with the Supreme Court's October sitting, "On the facts found the petitioner contends: Respondent's patent is invalid as claiming a device not patentable over prior disclosures.

"No element of invention is found in the asserted instinctive character of the operation of the control lever. The patent, if held valid in any respect, should be limited to a combination comprising a pair of certical control levels with a single integral

(*Concluded on page* 70)

The Story of North American

by BURTON KEMP

This is the interesting story of an up and coming airplane manufacturing plant that is an after growth of the old Fokker company. Other examples of North American planes will be found on page 14.

AT THE time a few years ago, when Tony Fokker went back to his native Netherlands, he left behind him his manufacturing company which had produced many transports and had tried its hand also—not very successfully, however—in the production of military aircraft.

This was ironical when we consider that his D-VII's, D-VIII's, and "Tripes" were the mainstays in the German Air Force only a few short years before.

Though some of the planes in our Army service were of the same type as the commercial transports of Fokker, and used in the same capacity, Fokker had endeavored to break into the other branches of Army aviation with such ships as the XA-7 low-wing attack monoplane and XB-8 mid-wing bomber.

The latter was mildly successful, but only when redesigned and redesignated as the YO-27. When the company merged with Berliner-Joyce, producers of the naval OJ-2 and P-16 Army bi-place observation, the name of General Aviation was given the new organization and the YO-27 was produced under this name.

Going back into the commercial field once again, the GA-43 single engined transport was produced which, although it was sold in small quantities abroad, never caught the fancy of any of the airline officials on this side. A similar tri-motored ship—the GA-38—was given quite a large portion of publicity for a time but then faded completely; it was never produced.

Then, in 1935, came another name change, another reorganization and a long move from Dundalk, Md., to the sunny shores of California. The new North American Aviation soon had a modern new plant, a new lease on life and some very advanced ideas on what was wanted in modern aircraft, particularly those of a military type.

With the help of the new technical experts who were added to the payroll, the NA-16 was turned out as the first North American product. Not only was an ATC granted to this plane as a commercial job, but it was entered in the 1935 Army basic trainer competition at Wright Field.

Here, the plane again showed its dependability and fine performance and was given the highest rating ever awarded to a basic trainer. Along with this came a contract for 95 planes of the same type, designated the BT-9 and BT-9A. Most were of the BT-9 type and upon completion were sent to Randolph Field, Texas, while the BT-9A's produced were slated for the Reserve Training Corps.

Just as the last ships were being completed in December, North American learned that additional contracts had been awarded calling for 117 BT-9B's and 33 BT-9C's, which follow immediately the previous order on the production line. The first type is for the Air Corps' training centers, while the latter is for reserve training. Both differ from the original model in only small details.

The new North American XO-47 3-place U. S. Army Air Corps Observation plane. "NAA" Photo.

After the North American factory had settled down to the production of one trainer a day, the development section of the company turned to a new plane, a design for an observation ship on line similar to the BT-9. A mid-wing, three place monoplane, it was sent to Wright Field early in 1936 and underwent the severe flight tests which have "washed out" more than one plane which failed to come up to the high standard required. But the rugged construction of this ship, the XO-47, was enough to carry it through to acceptance and purchase as standard equipment.

Everything at the North American factory is now being put into readiness to start production of the O-47 to the tune of 120. This will be delayed until next summer, necessitated by the time needed to produce the jigs and tools required, as well as to secure delivery of raw material. A larger personnel is planned on also, as well as a doubling of the 200,000 sq. ft. of floor space now being used. The new employees to be hired in the summer will augment the more than one thousand now on the payroll.

The North American O-47, like their BT-9, was ranked highest in its class after winning the Air Corps' competition. In the design of this ship the specific requirements of the observer were kept uppermost in the minds of the designers. He is amply protected, being sandwiched between the pilot and rear gunner in a fully transparent sliding hatch.

Accommodations for the entire crew are very roomy and the placing of the three occupants was decided upon before the structure of the fuselage was detailed. Ample room for photographing, mapping, and general observation work is provided, and the observer also acts as radio operator and relief pilot. The rear gunner, of course, is for protection from the rear, while the pilot is far forward with excellent visibility in all directions.

A Wright Cyclone of 850 HP. provides the power for this all-metal ship, and a three bladed controllable propeller is used to give improved takeoff characteristics. The engine cowling has been especially designed for efficient cooling and low drag. A faired retractable landing gear is used and also a fully disappearing tail wheel. A unique feature of the main landing gear legs is that they retract outward and up, contrary to usual procedure.

The outboard panels of the wing provide the recess for retraction, and this is almost fully covered with the gear in the "up" position. A large amount of dihedral is used, which improves stability, and the absence of the landing gear in flight increases the top speed, held secret at this time. Construction of the wing is of the full-cantilever type, the tail surfaces using the same features.

Landing lights are in the leading edge of the outboard panels of the wing; navigation lights are also provided. Besides its two-way radio, the cockpit is complete with instruments and a substantial metal tripod just to the rear of the pilot for the crew's protection. Trailing edge flaps on the under surface of the wing slow up landings.

And now we find that with contracts under their belt for two different types of Army aircraft the North American outfit is out after some more of the Air Corps "gravy." This was indicated when their "Dragon" was completed late last year, a mid-winged, twin-engined all-metal bomber that looks as vicious as it sounds.

It was developed after bids were announced for an advanced type of bomber for the Air Corps. This new bomber is said to exceed any similar ship in range and load-carrying ability, as well as being capable of exceeding it in top speed. It is fully equipped for high altitude, substratosphere flying and carries a crew of

(*Continued on page 52*)

XUM

A Gas Powered Aero-Sled

by DICK COLE

PART III

Here we have the third and last article dealing with the construction of a high-speed motor sled with the dimensioned assembly and detail drawings of the complete sled and its components.

IN this third and last article, we show the dimensioned details and sub-assemblies for the construction of a highly efficient powered sled. It is easy to build from easily available materials and it will prove a pride and joy to its owner.

The steel runners are forged from 3/16" x 2" spring steel stock, and are set in slots routed in the under side of the maple runners. After the steel runners have been shaped and the holes drilled, they are tempered and hollow-ground like skates.

The runners replace the original wheels between the wheel-hub flanges. In the case of the front runners it is necessary only to drive out the flange-bolts, separate the flanges, bore the hole in the runner to fit the hub, and then reassemble. But on the rear runners the brake-drums must be replaced with plain flanges. These can be cut from the old drums themselves.

The original auto front axle, and all of its parts, is used without any re-designing whatever, but the rear axle requires some simple remodeling. The driving axles are riveted into a thick-walled, iron pipe. The hubs are fitted to the taper end of the axles without keys so that the runners are free to oscillate. Of course the hub-nut must be left slightly loose. The original spring saddles can usually be used by shimming them up.

The claw-brake is forged from some old spring-leaf stock, and is operated by the left foot pedal. The emergency chain-brakes are made from old tire cross-chains. Under ordinary conditions the claw-brake affords sufficient control; the chains to be dropped only in an emergency. Since the claw-brake is operated by a *thrust* instead of a *pull*, ½" iron pipe is used as a brake-rod.

POPULAR AVIATION

This neat appearing power-sled can be built at a minimum cost by following the accompanying instructions and drawings.

The propeller shaft hangar and the driving pulleys are taken up in PLATE IV. First, one must visit an auto-wrecking yard and obtain a "heavy car" front wheel with stub axle and wheel bearings complete. A Packard—any old model—is particularly recommended, because the wheel bearings are wide apart.

Fig. 1 shows what is done to the wheel. The rim and all spokes except two are cut away. The wheel-hub becomes the propeller shaft hanger. Iron pipe is fitted over the two remaining spokes, and, together with the stay-rods, the hanger is supported very rigidly.

Now, using the original stub-axle as a pattern, the propeller shaft is designed to replace the stub-axle in the hub, using the original wheel bearings and races. This makes a very substantial, workmanlike job. The shaft can be machined from cold-rolled rod. If one lacks his own lathe facilities, a machine shop will turn out this shaft at a reasonable cost.

Now for the pulleys. These are turned in a wood lathe from laminated and bolted maple blocks. However, metal pulleys can be used on the prop shaft if desired. These, as well as the 72" V belts, can be bought at any store handling home workshop equipment.

The driving pulley must be designed to meet the requirements of the fly-wheel of the motor used. The turning of this pulley is well within the scope of the home workshop lathe. At this point one will see why a "Model T" is not readily adaptable to the aero-sled conversion.

The flat key method of securing the maple pulley to the prop shaft is practical and simple. The slot can be cut by drilling a series of holes and dressing up with a file. Metal pulleys, of course, are better. These can be pinned to the shaft with taper pins.

The making of an efficient propeller is an art in itself, and pages could be written on the "why" and "wherefores." Often one can pick up a suitable prop at an airport. Any propeller from 60" to 72", and with a pitch of from 3½ to 4½ feet, will function on the aero-sled.

If one wishes to carve his own prop a 64" spruce prop with a 4-foot constant pitch will prove quite satisfactory. Nowadays nearly every mechanic is more or less air-minded, and it is unnecessary to go into elaborate explanation of how to carve out a prop.

Probably most of the builders of the aero-sled will have experimented with gliders in their hey-dey, and "know their props." Of course, on the aero-sled, extreme accuracy and efficiency is not as essential as on a glider or airplane.

PLATE V, Fig. 1 shows the simple cooling system which is highly efficient and does not impair the stream-lining.

(*Concluded on page* 44)

PLATE III — RUNNERS AND MECHANICAL BRAKES

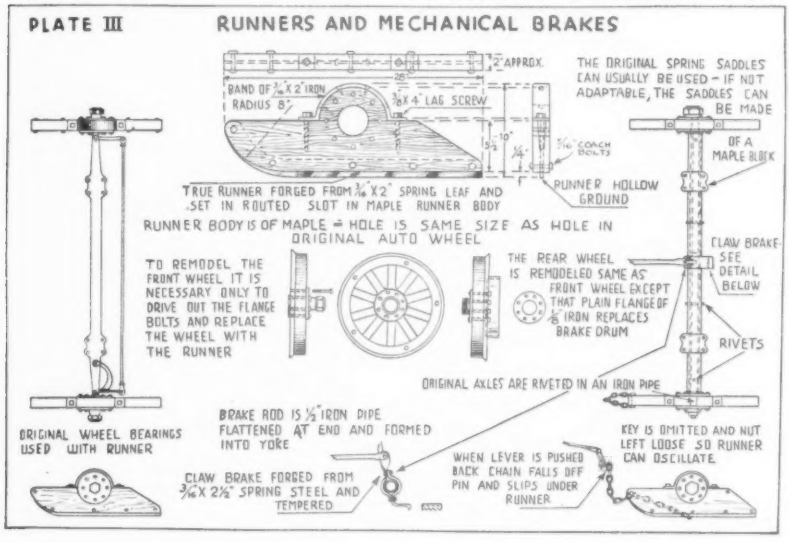
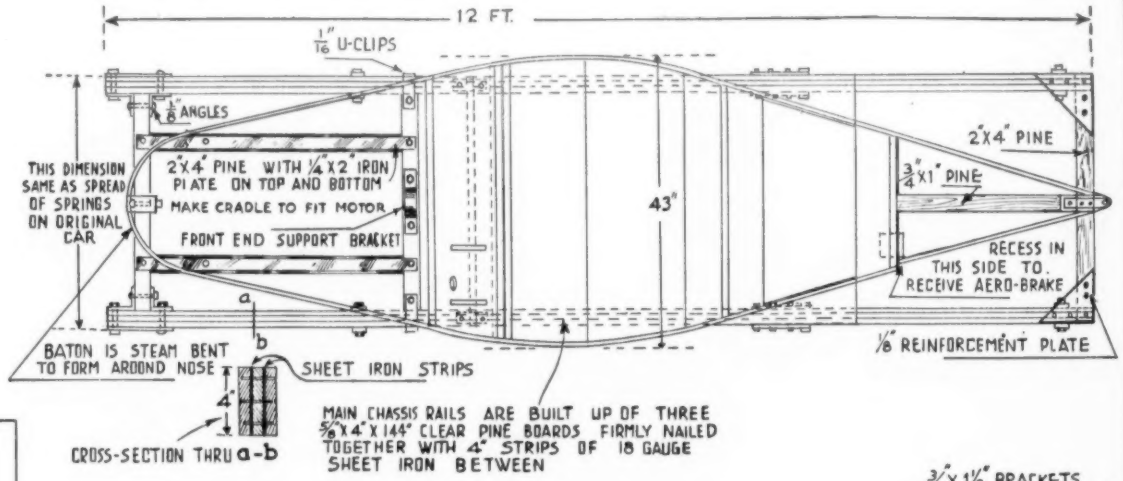

BAND OF 3/16" X 2" IRON RADIUS 8"
3/8" X 4" LAG SCREW
2" APPROX.
5/16" COACH BOLTS
THE ORIGINAL SPRING SADDLES CAN USUALLY BE USED - IF NOT ADAPTABLE, THE SADDLES CAN BE MADE OF A MAPLE BLOCK
TRUE RUNNER FORGED FROM 3/16" X 2" SPRING LEAF AND SET IN ROUTED SLOT IN MAPLE RUNNER BODY
RUNNER HOLLOW GROUND
RUNNER BODY IS OF MAPLE - HOLE IS SAME SIZE AS HOLE IN ORIGINAL AUTO WHEEL
TO REMODEL THE FRONT WHEEL IT IS NECESSARY ONLY TO DRIVE OUT THE FLANGE BOLTS AND REPLACE THE WHEEL WITH THE RUNNER
THE REAR WHEEL IS REMODELED SAME AS FRONT WHEEL EXCEPT THAT PLAIN FLANGE OF 1/8" IRON REPLACES BRAKE DRUM
CLAW BRAKE SEE DETAIL BELOW
RIVETS
ORIGINAL AXLES ARE RIVETED IN AN IRON PIPE
ORIGINAL WHEEL BEARINGS USED WITH RUNNER
BRAKE ROD IS ½" IRON PIPE FLATTENED AT END AND FORMED INTO YOKE
KEY IS OMITTED AND NUT LEFT LOOSE SO RUNNER CAN OSCILLATE
CLAW BRAKE FORGED FROM 3/16" X 2½" SPRING STEEL AND TEMPERED
WHEN LEVER IS PUSHED BACK CHAIN FALLS OFF PIN AND SLIPS UNDER RUNNER

PLATE II

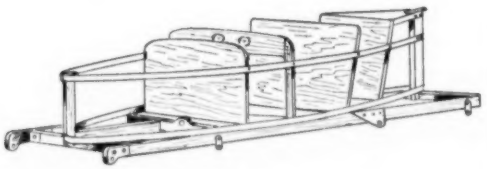
CHASSIS FRAME

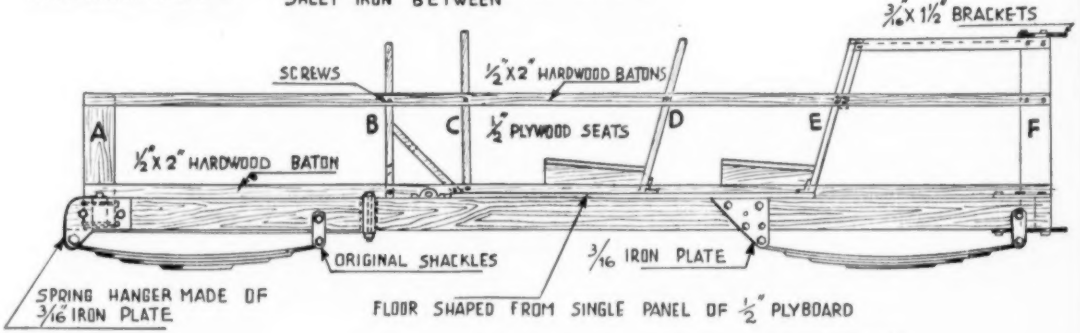
This sheet of drawings should be compared and checked up against the assembly drawings shown in the March issue of POPULAR AVIATION. This issue also contains pertinent remarks concerning the materials and the propeller.

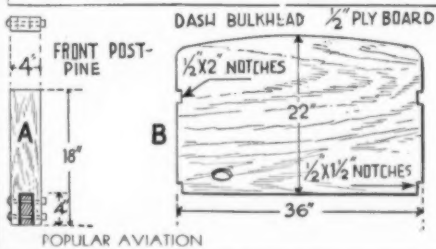

12 FT.
1/16" U-CLIPS
1/8" ANGLES
2"X4" PINE WITH 1/4"X2" IRON PLATE ON TOP AND BOTTOM
THIS DIMENSION SAME AS SPREAD OF SPRINGS ON ORIGINAL CAR
MAKE CRADLE TO FIT MOTOR
FRONT END SUPPORT BRACKET
43"
2"X4" PINE
3/4"X1" PINE
RECESS IN THIS SIDE TO RECEIVE AERO-BRAKE
1/8" REINFORCEMENT PLATE
BATON IS STEAM BENT TO FORM ARROND NOSE
a
b
SHEET IRON STRIPS
4"
CROSS-SECTION THRU a-b
MAIN CHASSIS RAILS ARE BUILT UP OF THREE 5/8"X4"X144" CLEAR PINE BOARDS FIRMLY NAILED TOGETHER WITH 4" STRIPS OF 18 GAUGE SHEET IRON BETWEEN

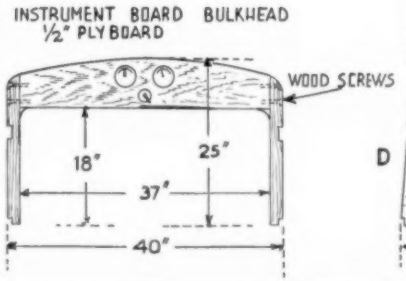
SHOWING GENERAL ASSEMBLY OF FRAME

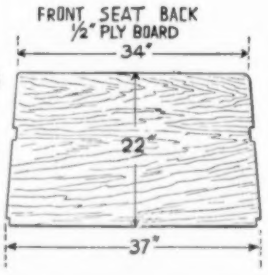
THE SKELETON FRAME IS COVERED WITH 22 GAUGE GALV. IRON (OR WITH SHEET ALUMINUM) — THE TOP OF MOTOR HOOD IS MADE REMOVABLE TO GIVE ACCESS TO THE MOTOR.

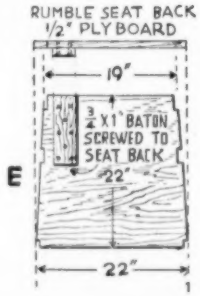


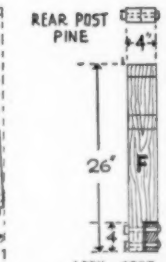












A Power Driven Sled

(*Continued from page 42*)

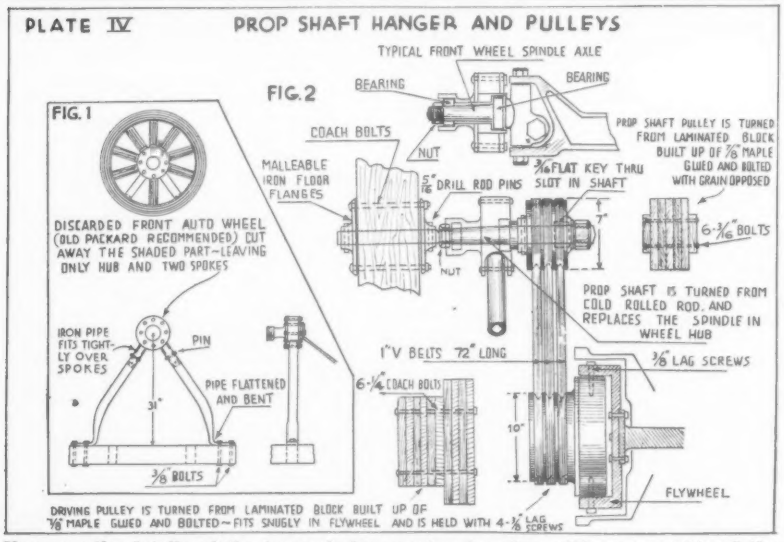


PLATE IV
PROP SHAFT HANGER AND PULLEYS
TYPICAL FRONT WHEEL SPINDLE AXLE
FIG. 2
BEARING
BEARING
FIG. 1
COACH BOLTS
NUT
PROP SHAFT PULLEY IS TURNED FROM LAMINATED BLOCK BUILT UP OF 7/8 MAPLE GLUED AND BOLTED WITH GRAIN OPPOSED
MALLEABLE IRON FLOOR FLANGES
5/16 DRILL ROD PINS
3/16 FLAT KEY THRU SLOT IN SHAFT
7"
6-3/16" BOLTS
NUT
DISCARDED FRONT AUTO WHEEL (OLD PACKARD RECOMMENDED) CUT AWAY THE SHADED PART—LEAVING ONLY HUB AND TWO SPOKES
PROP SHAFT IS TURNED FROM COLD ROLLED ROD, AND REPLACES THE SPINDLE IN WHEEL HUB
IRON PIPE FITS TIGHTLY OVER SPOKES
PIN
PIPE FLATTENED AND BENT
31"
1"V BELTS 72" LONG
3/8 LAG SCREWS
6-1/4" COACH BOLTS
10"
3/8 BOLTS
FLYWHEEL
DRIVING PULLEY IS TURNED FROM LAMINATED BLOCK BUILT UP OF 1/8" MAPLE GLUED AND BOLTED—FITS SNUGLY IN FLYWHEEL AND IS HELD WITH 4-3/8" LAG SCREWS

Here are the details of the transmission gearing together with an assembly of the various units.

Copper tubing can usually be picked up at a wrecking yard at "old metal" price. Suitable anti-freeze compound should be used the same as with an auto.

PLATE V, Fig. 2 discloses the details of the aero-brake. This unit consists of a 24" x 58" sheet of 22-gauge galvanized iron mounted on a strong angle-iron frame. As mentioned earlier, the aero-brake is used only at high speed. Its use quickly brings the speed from 90 to 100 miles an hour down to 30 or 35 miles, after which the claw-brake is used effectively. The aero-brake permits high speed with comparative safety. It is operated by the right pedal.

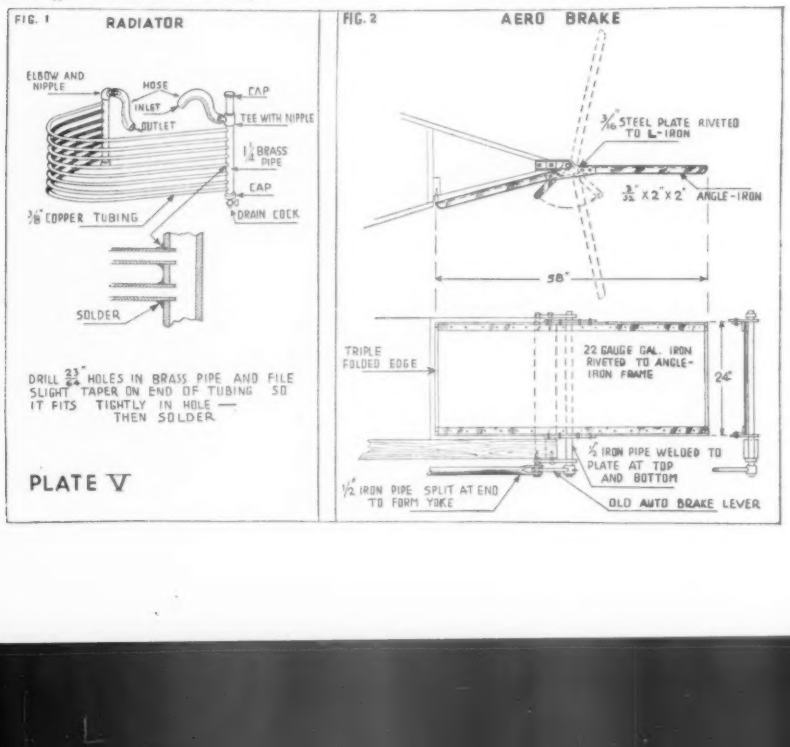
The slight dihedral angle of the surface inherently holds the aero-brake in a general right-angle position to the chassis. The highly vacuous condition set up back of the surface at high speed exerts a drag of several hundred pounds.

Many other minor constructional points are covered in the drawings themselves. The original steering column is used, but the steering-arm is bent to increase the leverage and limit the turning radius of the runners.

Of course, the exhaust from the motor must be carried to the rear the same as on a car. And the brake-pedals from the car must be slightly re-designed to meet the requirements of the sled. It is assumed that the builder possesses sufficient ingenuity to dope out the minor details.

In the wintertime, both in United States and in Canada, there are many long, frozen stretches of water where the aero-sled can be "given the gun," and its passengers will get an unforgettable speed thrill with comparative safety. This aero-sled is the slickest thing on runners.

END.



LANDING SPEED vs. WING AREA

by PEYTON AUTRY

IT IS always well for the designer of a conventional light aircraft for amateur or private use to make efforts in the design calculations to hold the landing speed fairly low.

A landing speed of 30-35 m.p.h. is a moderate value to design from. It is not advisable to set the landing speed as high as 45 m.p.h. or over unless for other special reasons of the design requirements.

Wing flaps lowered when landing are useful in this respect and offer a fertile field for improvement in the performance and design of amateur aircraft, and they offer no great difficulties for the home-builder as is generally thought to be the case.

As is commonly known the landing speed is directly dependent on the lift coefficient of the wing section used and the wing loading or the gross weight divided by the wing area. It is also impractical for the landing speed and wing loading to be too low as this involves "fair weather" characteristics.

The wing loading in this case should not be less than 3 lbs. / sq. ft. of wing area, for powered aircraft of the light type. In terms of the landing speed this value should not be less than 25-30 m.p.h.

It can be readily seen that with a given gross weight and landing speed, the wing area can be computed through the following formulae and equations.

$$Vs = 19.8 \sqrt{\frac{Wl}{Clm}}$$

Where:—

W = Gross Weight

S = Wing Area

Wl = Wing loading (W/S) lbs./ sq. ft.

Vs = Landing Speed

Clm = maximum lift coefficient

Then:—

$$Wl = \frac{Clm\ Vs^2}{19.8^2}$$

or—

$$Wl = \frac{Clm\ Vs^2}{392.04}$$

Then the wing area is found—

$$S = \frac{W}{Wl}$$

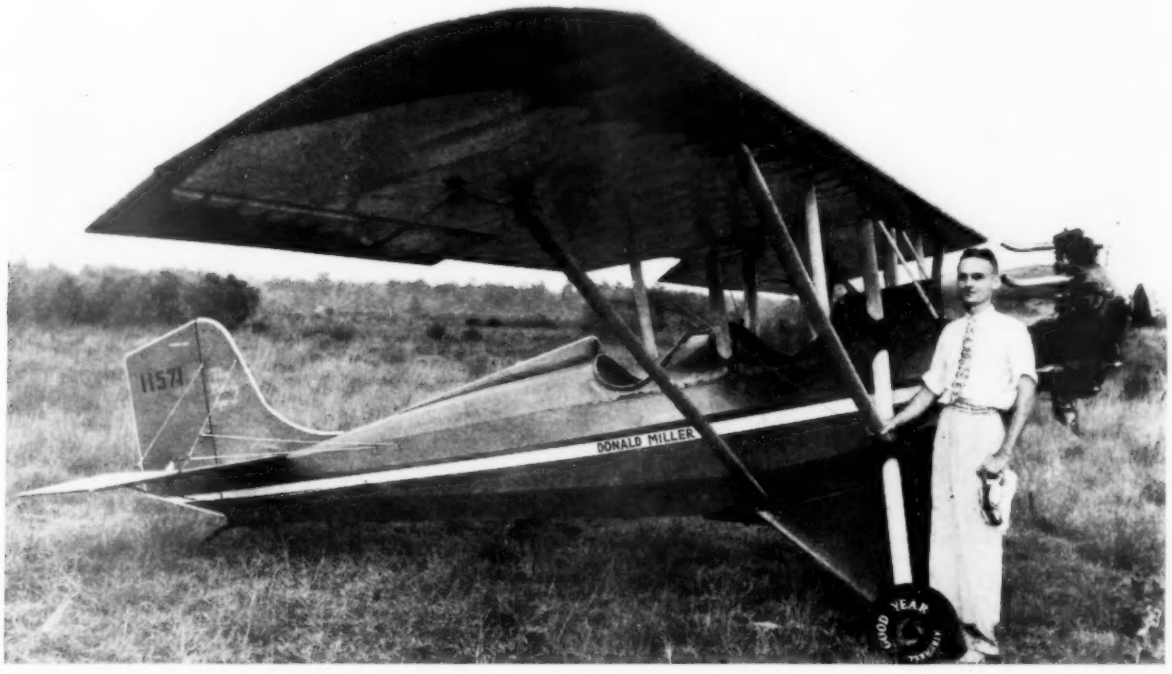
Thus the wing area for a desired landing speed can be found by running the common dependent factors through the above simple formulae and equations.

Our April Back Cover

THE Waco Model CJC on the back cover of this issue, is a four-place cabin job with a 250 horsepower Wright engine. It is interesting to note that this plane, which belongs to the Crusader Oil Corp., is an exact duplicate of the 25 Wacos furnished to the Brazilian Army Air Service. Four more are used by the Brazilian Navy.

What Our Readers Are Building

Just to prove that many of our readers are mighty active in this aviation game and enthused to the point where they engage in the construction of their own planes, engines and gliders, we present this department to inspire other readers. Soooo—just get out your saw and hatchet and help this column along.



And here is the hero of our tale, Donald Miller of Gadsden, Ala., with his modified Pietenpol plane. This is one of the best looking and highly finished jobs presented to date, and Mr. Miller says that she is a fine performer as well.

WE now resume "Our Readers" department which, for certain good and valid reasons, has been omitted from P. A. during the past few months.

The steady demand for the renewal of the homebuilders' department and the great interest displayed in amateur activities have proved this to be one of the most popular departments in the magazine if the number of requests can be taken as a criterion of its value.

And so-o-o, we'll start out with a description of the Pietenpol owned by Donald Miller, Gadsden, Ala., who is quite enthusiastic over the performance of the "Piet" and who believes that he owns the fastest and the best performing ship of this type yet built. He very kindly sent us the excellent photograph that accompanies this description and this picture is of great assistance in judging the workmanship of the little ship.

To begin, the plane was built by H. S. Barry of Birmingham, Ala., in 1933 and is the last of three successful Pietenpols built by Mr. Barry. As is usual, the builder made several departures from the original design to satisfy his own ideas and beliefs.

The Barry-built Pietenpol does not have the standard one-piece Pietenpol wing but, instead, is built with two outer and one center-section, the gas tank being built into the center section. The fuselage is the regular Pietenpol wood fuselage except that it is slightly shorter than the standard.

However, the landing gear is a wide departure from the standard design. It is of the rigid type, made of steel tubing, and so arranged that all of the shock is absorbed through the Goodyear air-wheels. While this landing gear is not suitable for pancaking or rough student landings, it has given no trouble in the hands of Mr. Miller or in the hands of other pilots having more than 30-hours flying experience. Its simplicity is the great feature of this design.

A Velie M-5 engine of 65-horsepower provides the motive power which, together with a Supreme propeller, gives the Piet a top speed of 107 m.p.h. and a cruising speed of 89 m.p.h. at an engine speed of 1,700 r.p.m. The climbing rate is 400 feet per minute. This is certainly excellent performance and yet the high speed is not reflected back into a high landing speed, the latter being quoted at 45 m.p.h. With the tank now installed, the radius at cruising speed is about 225 miles (16 gallons).

Mr. Miller states that he has flown this ship cross-country under very adverse conditions and has never had any trouble of any nature. He is planning to close up the front cockpit and to install a 14-gallon tank which will be connected to the present 14-gallon tank through a wobble pump. This additional gasoline capacity should give the ship a cruising range of 450 miles.

A close examination of the large photograph shows excellent workmanship, fully the equal of a fine factory built plane. And when we look back upon the multitude of other planes that have appeared from time to time in these columns, we are impressed with the very high standards of workmanship displayed by the home-builders and the fine performance that they have attained.

Mr. Miller is in attendance at the University of Alabama, but because of parental objections, he did not take the plane to school with him this year. However, on the principle that "absence makes the heart grow fonder," this should give added zest to his homecoming. He writes:

"I hope this letter and photograph will help get 'What Our Readers Are Building' back into good ole' P. A. As I haven't seen this column for some time I thought you lacked material so I took this opportunity to show my job."

Thanks a lot for the description and pix and we assure you that this column will continue as long as we have any ammunition left for running it.

The boys have sent in a bunch of material since our discontinuance of this department, and we will be running double shift for a while.

(*Concluded on page* 71)

Crash Hunting for Gas Models

by JOE R. NEIL

An interesting and instructive article, taken at an unusual angle, for gas model fans. Chasing up and analyzing gas model crashes involves both model knowledge and photography.

OBSERVED from any angle it is a neat ship. A very neat ship. High winged monoplane to be sure, with a generous gift of dihedral, nevertheless of a trim, sturdy design that plainly speaks airworthiness.

The long tapered wings of a Boeing airliner tie into the top of a fuselage with the graceful strength of an Army Bomber. A gear that perches its nose a little high but that looks like it could stand up under the wallop of the hardest, fastest landing. A motor that drones easily in the throes of its warming up routine all combine to make an exceedingly attractive, if not a thrilling picture.

However, from your point of observation, about forty feet behind its quivering tail, you find yourself not so much interested in the design of the ship as in its performance, which you are just about to witness through the finder of your Cine'-Kodak.

What you see, of course, as you train the camera, is an image which considerably diminishes the fine points; still you can't help noticing the particularly appealing lines. You are experiencing a mild form of excitement.

You hope something interesting will happen but you hardly expect it. It is not your idea to take this picture Your film library is well stocked with take-off shots. What you are planning is to cover the flight from start to finish—keep the camera focused for a "take" in case of trouble.

Suddenly, the little craft takes a short run up wind, leaps lightly into the air—its little motor drumming out a song of power which drifts back rhythmically to semi-conscious ears. Semi-conscious because your eye watching the image through the finder, at that time, is the only fully conscious organ of your body.

The ship climbs fast. Too fast. Then, as a gust of wind catches under the wing, it shoots straight up, and, for a split second, hangs motionless on its prop. A thrill like an electric shock runs through you and passes out to your thumb on the camera's starting button. The motor, too powerful to stall, beats hopelessly at the air; then, taking a wing-over, the plane plunges into a power dive, heads right for you from an altitude of sixty feet. It's a crack-up sure.

Your first impulse is to stand your ground and grind away like any good photographer should but, in the brief interval in which it becomes apparent you are standing on the spot marked "X," you realize that rather distant looking object may be considerably closer than you think.

So as it pours itself out of the sky snarling like a flock of Walt Disney's hornets, you find time for two panicky steps—barely enough to clear the crash. No pictures of that one, certainly. But as you examine the wreckage to see what damage was done you're not very sorry you got out of the way.

Here's the good old standard nose-into-the-ground type of crash, that speaks of poor design and adjustment.

The fourteen inch prop which was reving up to about four thousand R.P.M. when it whipped into the soft earth is a mere hub on the drive shaft. The motor and its mounting have stood the shock as has the fuselage, but the wing, although remaining intact, has been ripped off, cast forward over the crushed nose. The gear has been badly smashed. But that is not at all bad.

When the whole ship weighs only a little over four pounds and nearly half that weight is in the motor, flashlight cell and spark coil, it attests well for the workmanship and design of a seven foot wing and a four foot fuselage structure when they stand up under the impact of a fifty mile per hour crash.

Making amateur movies of gas powered model plans is a fascinating hobby, especially if the scenes are shot on broad expanses of open ground where there are no objects in the immediate vicinity to indicate relative size. When such scale model pictures flash across a beaded screen they appear to show real ships taking-off, flying, stunting, landing and sometimes crashing as though there were a pilot at the controls.

The thrill of the hobby comes with the crashes. And crashes have to be hunted. They don't crack up models just for the sake of a picture. If the camera isn't focused on the flight at all times the scene may come and slip away before there's time to catch it.

It is easy to get good take-off shots and crashes which occur during the first part of a flight. A station about two hundred feet ahead and a little down wind from the ship

(*Concluded on page* 64)

And here she whams into a tree, but without much damage to the ship.

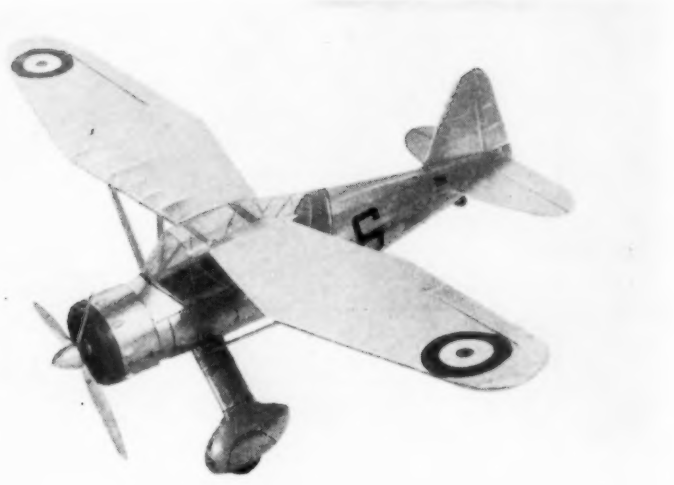
Alas, caught in the telephone or telegraph wires with one wing already in shreds.

Building the Westland "Co-Op"

by

PAUL W. LINDBERG

Model Editor and Model Designer
for POPULAR AVIATION.



A glance at the front-cover drawing will show that this model is an exact replica of the full-size Westland monoplane.

THIS machine is intended for use in the Royal Air Force and is capable of very high speeds. Its clean lines, together with good stability, assures us of excellent performances. All improved features have been worked into the model, such as movable controls with aluminum hinges, together with all other details to make it an exact scale model.

COLOR SCHEME

Entire model—aluminum, front part of cowl—red, details—black.

CONSTRUCTION OF FUSELAGE

It is necessary to place a sheet of ordinary wax paper over the plan to prevent cement from sticking to it. In building the fuselage, construct one side at a time. The longerons, vertical and diagonal braces, etc., are held in place until securely cemented, by inserting straight pins on either side of strips.

After the two fuselage sides are completed, they are pinned to top view of the plan in such a manner that the top longerons face down and the sides are at right angles with the table. The cross-members are now cemented in place, forming a rectangular fuselage.

Cut formers from $\frac{1}{16}$-inch sheet balsa and cement in their respective positions as shown on plan.

Balsa nose plate is built up from $\frac{1}{8}$-inch sheet balsa. Stiff paper is required between nose plate and formers.

All framework which consists of the fuselage cabin is made of wire.

CONSTRUCTION OF MOTOR

The cylinders are carved and sanded from balsa blocks. When nine cylinders have been formed, wind heavy thread around them to represent fins. Make crankcase from two pieces of balsa. Rocker arms housings, push rods and other small details of motor are made of balsa.

CONSTRUCTION OF WINGS

Cut all ribs from $\frac{1}{16}$-inch balsa. Pin the spar in position on the plan. Now, cement ribs in their proper locations. The leading and trailing edges are cut and sanded to shape and cemented to the ribs.

The panels carry movable ailerons which are a great help in controlling the flights. Make wing tips from $\frac{1}{16}$-inch thick balsa. We highly approve of this type of wing tip, because it is much easier to construct and neater in appearance.

CONSTRUCTION OF ELEVATOR AND RUDDER

These are built from $\frac{1}{16}$-inch square and flat balsa, and are constructed on the plan. Their construction is very simple, therefore, no difficulty should be encountered here.

CONSTRUCTION OF THE LANDING GEAR

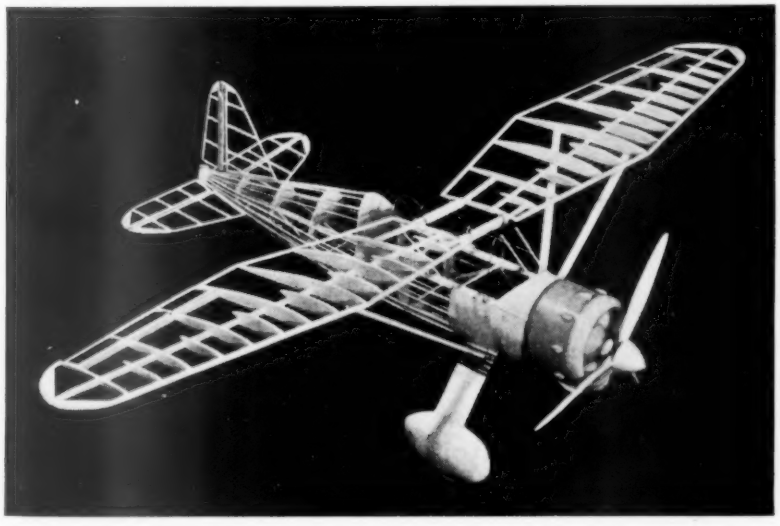
After the struts have been cemented together, cement them to the streamline wheel coverings. The wheel coverings are carved from three pieces of balsa which have been cemented together. The method in which the landing gear struts are attached to the fuselage is plainly shown in detail on plan.

COVERING THE MODEL

Apply tissue to the various framework members, using a light grade model airplane dope to fasten it to the outer edges. Stretch tissue as tightly as possible to remove all wrinkles. When edges have dried, apply coat of water to tissue. When all water has dried completely, tissue will become taut. May we suggest that you pin wings, elevator and such to flat surface. This prevents warping.

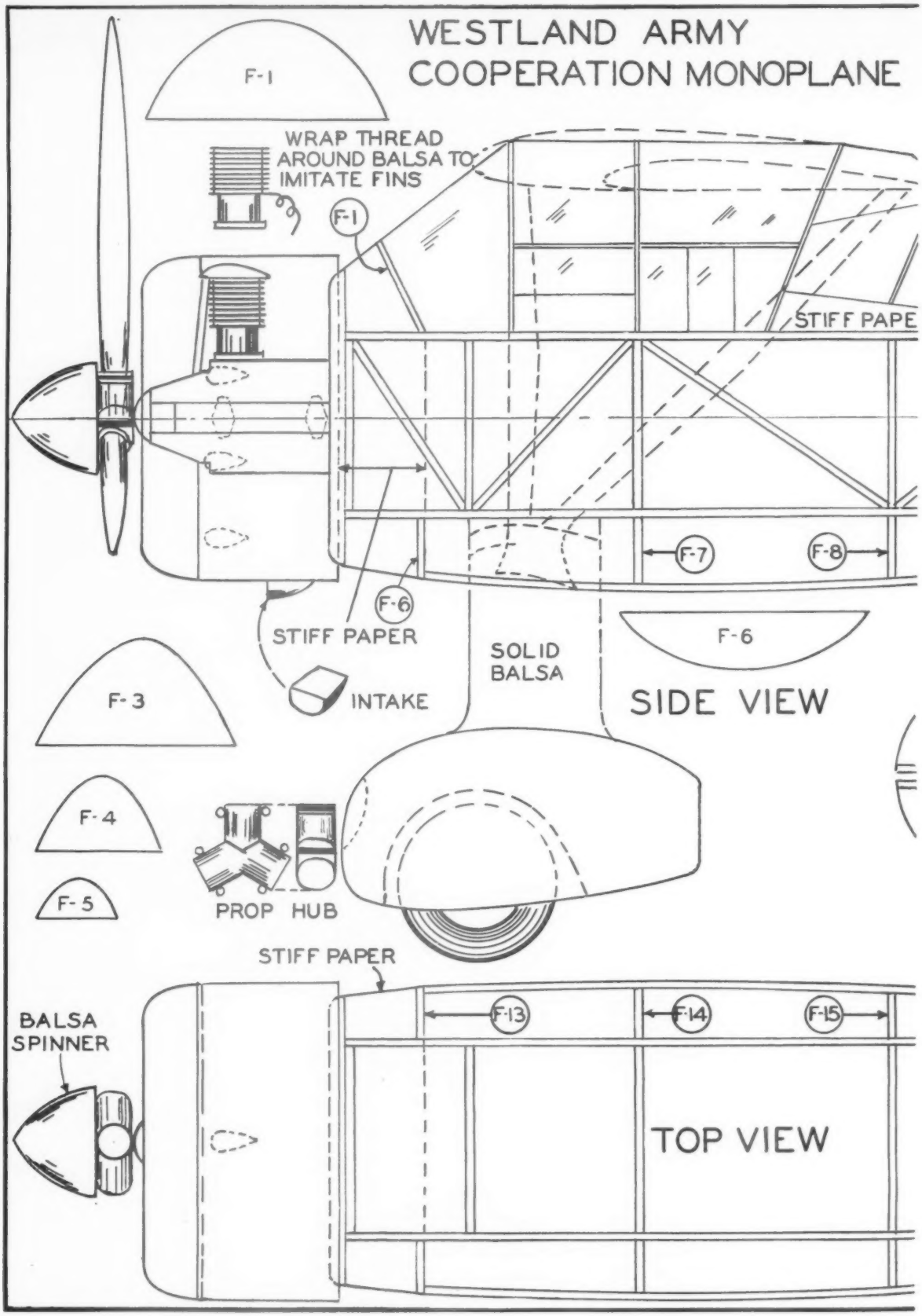
ASSEMBLY

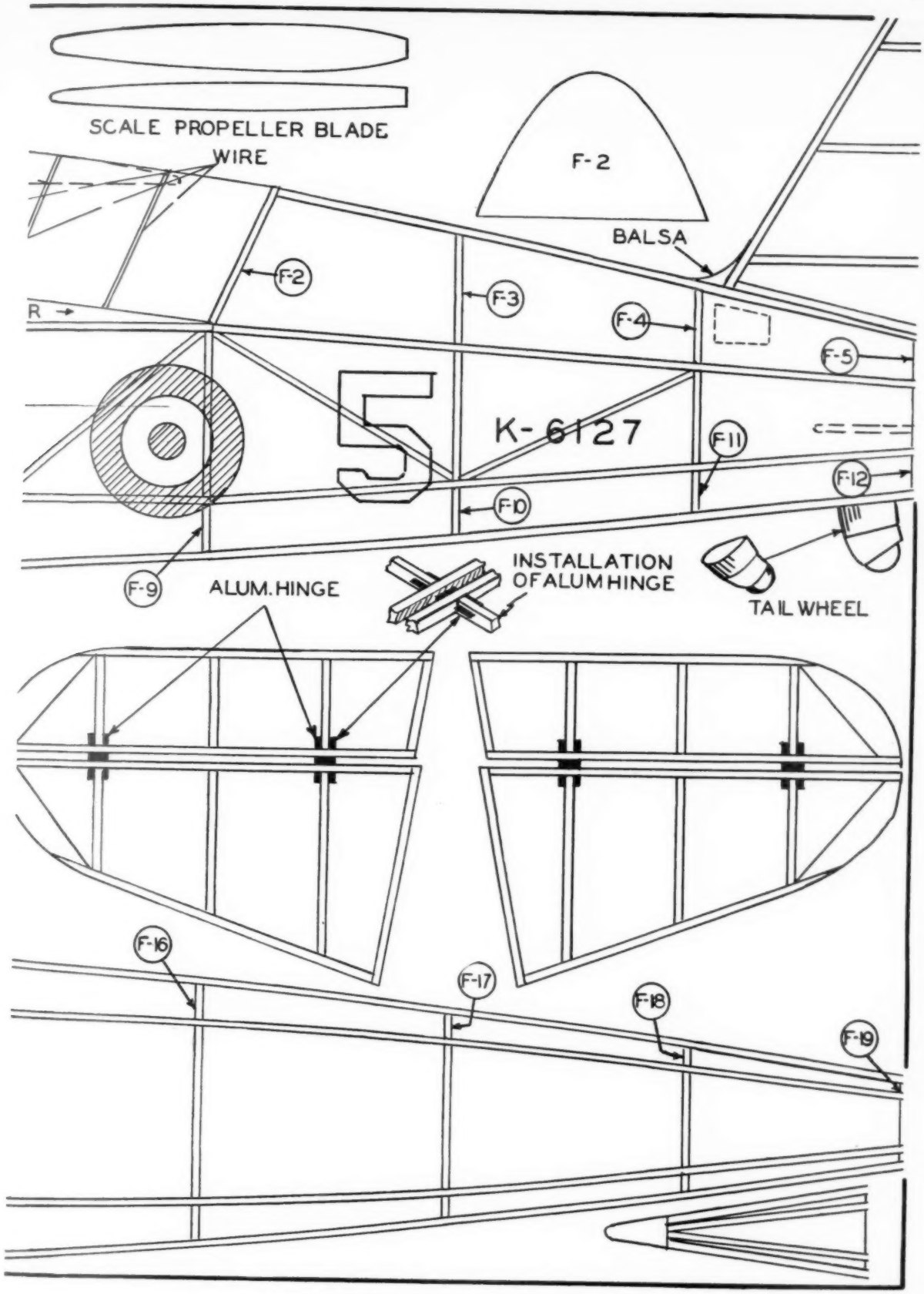
After the various parts have been covered, wing panel can be cemented into position. The wing struts are next cemented into position. Markings on both sides of fuselage can be painted on white paper, cut out and cemented to model. Other small details can be drawn with pen and ink and cemented to correct positions on model. All details clearly shown on plan.

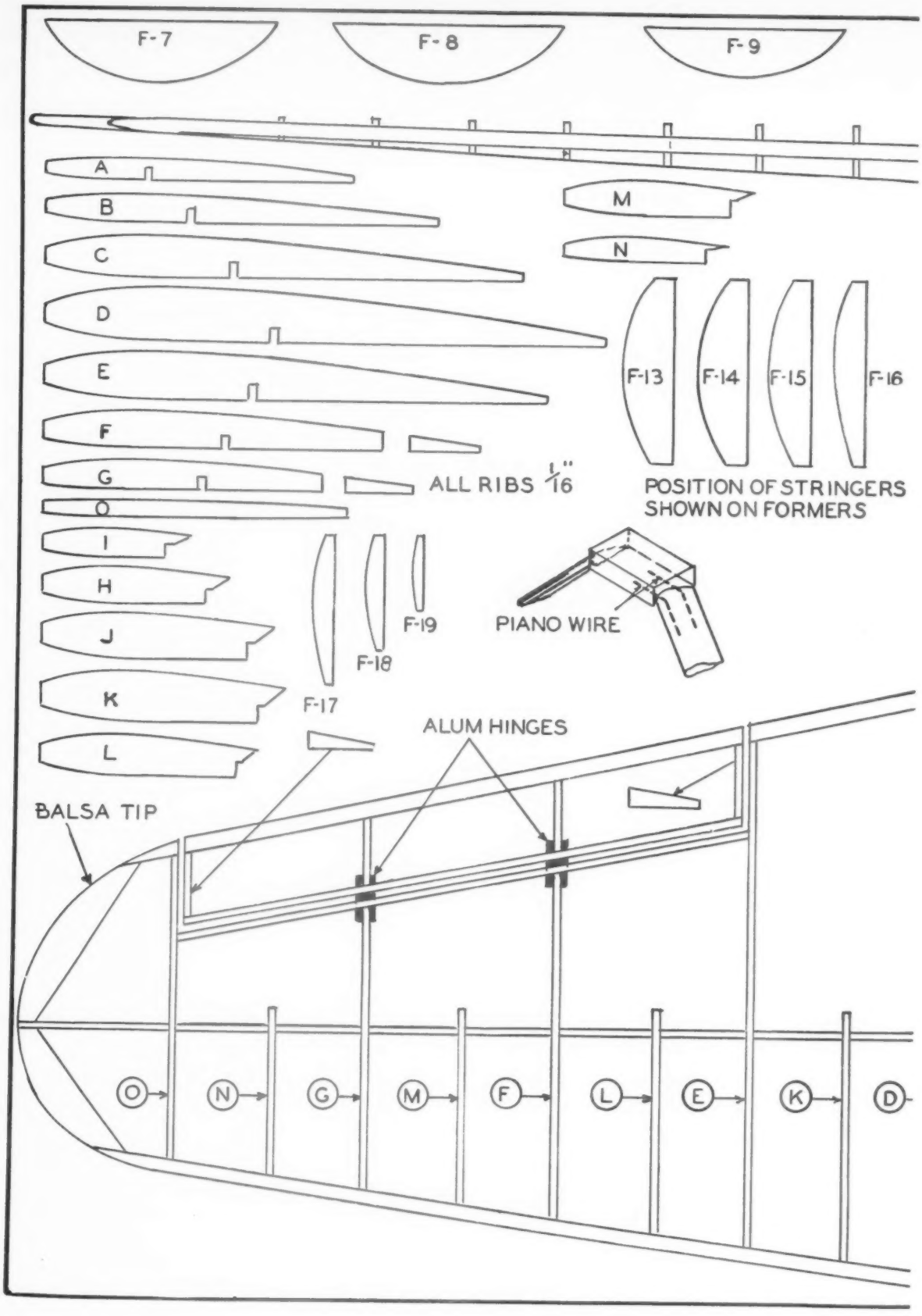


The Westland monoplane model before covering, showing the peculiar wing outline.

XUM


WESTLAND ARMY
COOPERATION MONOPLANE
F-1
WRAP THREAD
AROUND BALSA TO
IMITATE FINS
F-1
STIFF PAPE
F-7
F-8
F-6
STIFF PAPER
INTAKE
SOLID
BALSA
F-6
SIDE VIEW
F-3
F-4
F-5
PROP HUB
STIFF PAPER
BALSA
SPINNER
F-13
F-14
F-15
TOP VIEW


SCALE PROPELLER BLADE
WIRE
F-2
BALSA
F-2
F-3
F-4
F-5
R
K-6127
F-11
F-12
F-10
F-9
ALUM. HINGE
INSTALLATION
OF ALUM HINGE
TAIL WHEEL
F-16
F-17
F-18
F-19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F-14
F-15
F-16
ALL RIBS 1/16"
POSITION OF STRINGERS
SHOWN ON FORMERS
F-17
F-18
F-19
PIANO WIRE
ALUM HINGES
BALSA TIP
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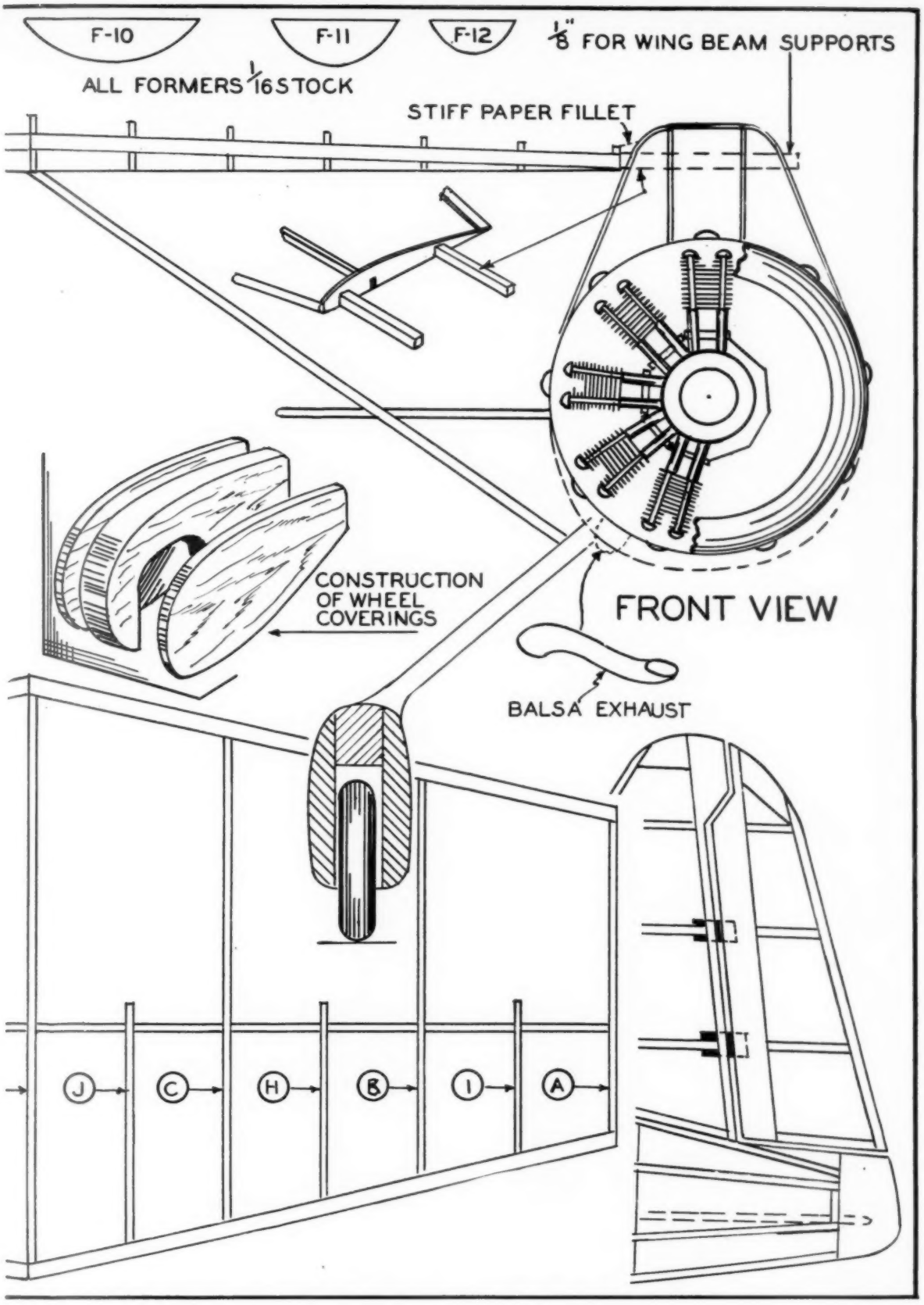
F-10
F-11
F-12
1/8" FOR WING BEAM SUPPORTS
ALL FORMERS 1/16 STOCK
STIFF PAPER FILLET
CONSTRUCTION OF WHEEL COVERINGS
FRONT VIEW
BALSA EXHAUST
J
C
H
B
I
A

Helicopter

(*Continued from page 32*)

la in quick up and down motions—what happens? As we bring it on the down-stroke the air pressure underneath this parasol increases—closing the blades so that they overlap one another immediately.

And the completion of the down stroke has exerted an enormous air pressure which has lifting power. Then on the up-stroke the pressure of air strikes the closed blades and forces them open—the slits widen, and we again have merely the ribs to shove up into the air, where the valves close again and we again have pressure under the umbrella.

Now, let's speed up this procedure so that it hops up and down with the speed of an automatic cocktail shaker—at the same time revolving, of course. That is the manner in which the umbrella plane lifts from the ground. Then, at the desired altitude the pilot tilts the propeller at an angle, like one walking against the wind with an umbrella, so that the propeller not only lifts on its down stroke, but pulls forward also. Then landing is accomplished by throttling the motor with umbrella pointed straight up, in sort of a parachute fashion. In all, it lends a gyroscopic stability while in the air in this manner.

The photograph of the machine standing idle will give you a fair conception of the propeller. Here you notice the ribs with the blades dangling down at "open" and notice the sunlight shining through the propeller openings down on the propeller shaft-housing.

The undercarriage is mounted on four wheels, but this is simply in order to transport the machine, by pushing or towing, to an open spot for a takeoff or for rolling it into its hangar.

Now, I would like to describe the actual takeoff of this umbrella plane, as seen in the action photograph. Notice the flexibility of the propeller.

Pilot Davis steps over and listens to the motor. As it warms up he inspects the machine critically from all sides and all angles. I set up my movie camera, as I was covering this for International Newsreel. My assistant trained the speed Graphic still-camera on the little machine.

We were all set for the fireworks. We were about to photograph something that could pull itself up by its own bootstraps, literally speaking. And that's some stunt. So we eagerly waited.

Jack Davis donned helmet and goggles. It was a warm summer day, hardly a breath of air stirring. The plane's motor struck out a slow, staccato beat; the crowd around backed away to a safer vantage point.

Pilot Davis took his seat at the extreme rear of the machine, strapping himself down to it tightly. He gave the motor a few bursts with the gun—then slowly—very slowly the big prop began to turn, in that crazy up and down, rising and falling motion. As it gained speed the swish of the blades became a crescendo, and the whole machine began to buck—like a rootin'- tootin'- hootin'- shootin'-rodeo cayuse trying to throw his rider—or in this case, the pilot. But Jack stuck with it and gave it more gun.

The propeller fairly screamed and suddenly, very suddenly the little buggy lifted straight up like a balloon, and it hung there in space—like a living monster from some other world. Then slowly it pancaked down to earth, the propeller clutch slipping. The thing was so unreal, it sort of made one shiver to look at it—certainly a new departure in aeronautics if there ever was one. And it was a swell newsreel subject.

END

North American

(*Continued from page 41*)

ten with some of them manning guns mounted in new positions.

At present the Dragon is undergoing factory tests with Lt.-Comm. D. W. "Tommy" Tomlinson as chief test pilot. Tomlinson is the man who established many records while flying TWA's Douglas DC-1, which since has become the private ship of Howard Hughes.

Regularly a TWA executive, Tomlinson has been given a leave of absence from this position to fully test this ship before it is sent to Wright Field in March for entrance in the 1937 bomber competition. After its first tests Tomlinson, former leader of the "Three Navy Hawks," said of the Dragon—"The airplane has excellent flying and landing characteristics and will make a magnificent military weapon."

The fuselage is of semi-monocoque construction and provision is made in it to carry the largest bomb load of any airplane to date. To accommodate this load and also provide spacious quarters for the crew, the fuselage is of tremendous size, but is so designed that it produces less drag than the fuselage of a transport ship of similar type. The main control room in the upper portion of the nose of the ship has adjustable upholstered seats for pilot, co-pilot, commanding officer, and navigator.

New features for navigation using either the heavenly bodies or the ground for bearings are used, and bunks so that two of the crew may sleep during long flights are also included. Some aids for the pilot are Sperry automatic pilot and stabilizer, with de-icing shoes on leading edges of wing and tail. The portion of the ship which houses the crew is soundproofed, ventilated, and heated; the cabin is sealed for comfortable operation at the high altitudes for which the Dragon is designed. At one point the fuselage attains a maximum cross-section of twelve feet by seven.

Many newly evolved structural arrangements are incorporated in the ship. Main among these is the center section of the wing, in which accommodations are made for the two engines. Like the entire ship, this portion has a stressed metal skin, but in this case extra strong material is used and a liquid tight compartment is the result. This is divided into four sections, each serving as a main fuel tank. Combined they give a fuel capacity larger than that of any American land plane; here lies one of the main reasons for the tremendously long range obtained.

In addition, about half a ton of weight is eliminated along with the elimination of ordinary tanks; thus, it can be seen that the useful load is increased accordingly. Another advantage in the new type of gasoline stowage is the increased maneuverability due to the concentration of the tremendous weight of the gasoline near the center of gravity.

Although the single spar outer wing panels are of simpler design than previous wings of this type, they are stronger and more resistant to twisting.

(*To be concluded in May issue*)

PROF. HARRIMAN HAD INGENUITY

. . . but 1883 had no gasoline

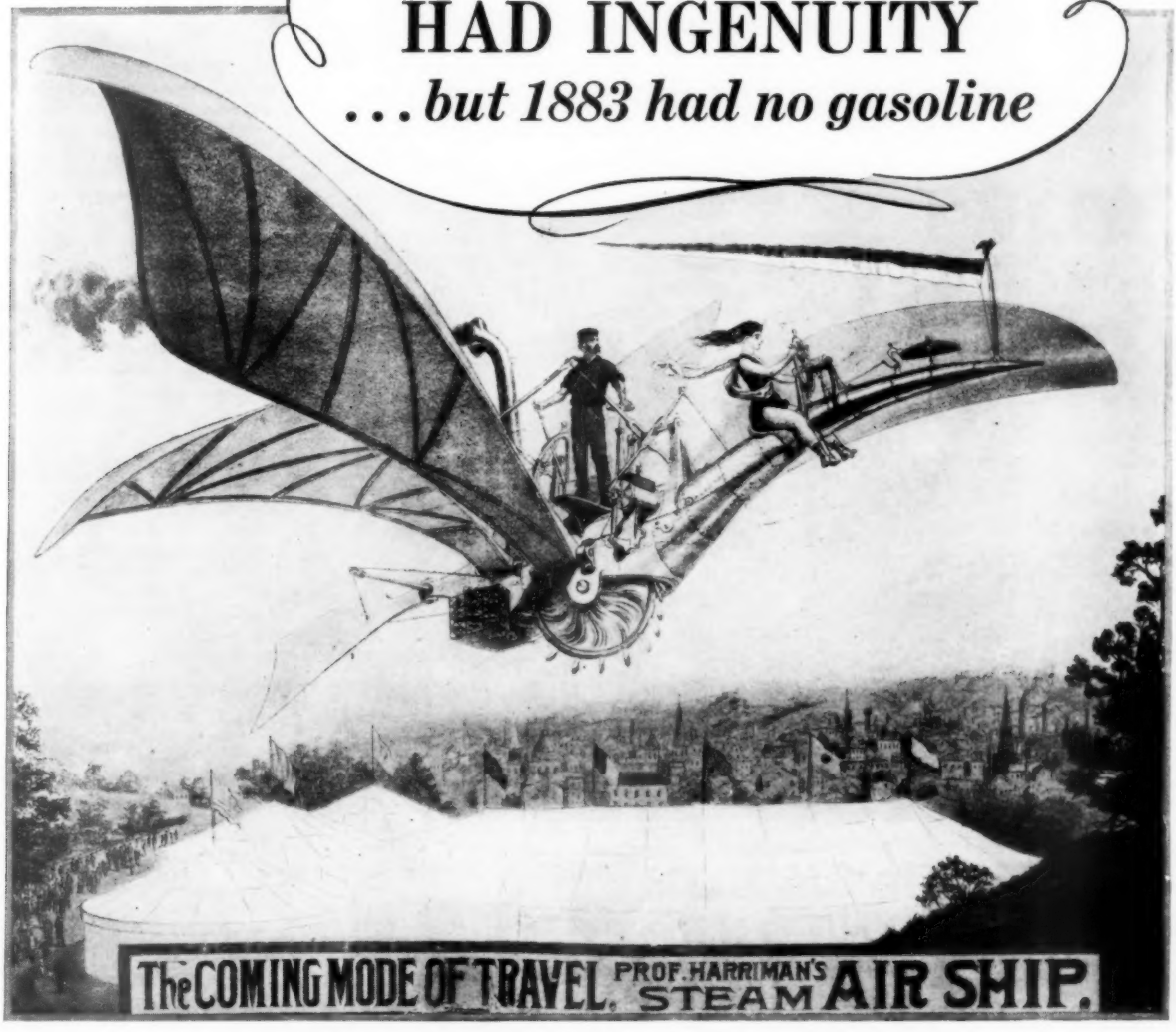

Illustration above from a circus poster drawn in 1883 by Emil Roe and now in the Bella C. Landauer Collection. Certainly in those days it must have been daring . . . as well as fanciful. Imagine the sensation aroused by the modern bathing-beauty uniform of the attractive co-pilot!

FIFTY-FOUR YEARS AGO . . . ladies in bustles and bewhiskered gentlemen were "ah-ing" and "oh-ing" at this circus poster . . . and paying their dimes to get into "Bartlett's Monster Railroad Show" and scoff. And well they might. For the dreams of flying machines in '83 lacked not only structural essentials, but would-be inventors also lacked gasoline motors, electrical devices, and a hundred other integral parts of "The Coming Mode of Travel." Changing this clanking dinosaur of Professor Harriman's imagination into the airplane of today has been accomplished—not alone by inventors, engineers, and the pioneers of aviation, but also by the research laboratories of electricity, metallurgy, chemistry, and petroleum.

Even the gasoline that succeeded at Kitty Hawk in 1903 would scarcely satisfy the airliners of today. In fact, 1937 performance with Ethyl Aviation Gasoline offers an interesting contrast to the performance of only a few years ago. Ethyl Gasoline Corporation, Chrysler Building, New York City.

XUM

Micky McGuire

(*Continued from page 28*)

opened the throttle wide and the ground beneath us fell away as that old tin-pan motor sizzled.

We were sitting side by side right out in front with nothing around or below us but air. McGurrin was huddled up on the Francis' landing gear axle under the lower wing facing backwards. He waved to us and we waved back. The field below was getting smaller. How that Wright did vibrate as Micky forced it higher and higher. We were close to the Francis' ship so I peeked into the hood of the camera. McGuire peeked, too, but couldn't see anything so he yelled, "Not yet."

Roy Francis' motor was smoking, leaving a ribbon of white behind it. I could see Lake Michigan and Chicago in the distance. McGurrin waved again and soon we eased off climbing. The vibrations lessened and we were straightened out now—cruising.

We kept our eyes glued on that Francis' ship. Then the smoke from his motor cut off—Francis had throttled—it was McGurrin's signal to jump. We were close—I was looking through the Graflex—I held my breath—then a form slid off that axle dropping into midair, the camera clicked—we nosed over. . . . But Lady Luck was not on that parachute with McGurrin that day.

We landed close to where McGurrin lay on the field sprawled out. A car driven by R. W. Shroeder (now chief of airline inspection, Department of Aeronautics) raced over the rough field and stopped. We lifted McGurrin in and headed for the hospital. The show was over.

At the hospital they put McGurrin in a hammock to hold him together—cutting off his clothing. About four doctors were working on him. We phoned his father then sent a wire to his sweetheart in New York. Then we stuck right there all night watching the medicos and hoping McGurrin would "come to."

He was pretty far gone. The following morning the Colonel arrived and took his still unconscious boy back to Grand Rapids. We left to keep a Fair date that afternoon. That one picture of the jump turned out O. K. But we had lost our "added attraction."

McGuire didn't fly with the same gusto after that nor flirt with high obstacles in his path, and telephone companies quit worrying about their poles. Micky "stunted" but at safe altitudes so he ceased being a sensation. Furthermore the ship was going hay-wire and he didn't want to lose the wings, which seemed to be "wished on." We needed a new ship but above all some aerial novelty for a climax or thriller.

All interest was now centered upon the outbreak of the World War. The press carried vivid articles describing how German aviators were literally acting as eyes of the army, meanwhile bombing enemy strongholds while on observation duty. U. S. had not entered the conflict as yet but the American public was interested. What the airplane could do in time of war was an important question.

Here, then, was a real feature. To demonstrate this aerial weapon we could "bomb" circles on a field, using small bags of flour for ammunition for these bags would burst and leave a white mark where they struck.

We tried it. I sat on a wing (as there was only a pilot's seat on the "Shooting Star") with a basket of "bombs" between my knees. I held on to a strut and with careful aim, I dropped little bags at the whitewashed circles below.

The "bombs" floated through the air, blown by wind, more often landing among spectators and showering them with flour, than on the field. But it was dangerous to drop anything heavier. Besides my added weight and wind resistance out on the wing stalled the little ship, causing us to fly wing-low or slip. Another good idea shot for the want of a new ship.

Air pictures were in demand and I could see a future in flying a camera plane. The movies needed thrillers so we decided to winter in California and try out this phase of the business.

I bought a camera from a newsreel man and proceeded to waste hundreds of feet of film on aerial nothingness, such as, "Reel No. 1. The stock-yards from where you can't smell them." "Reel No. 2. While Gary's steel mills unfold." Both of these

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reels looked alike so we had to number them.

Micky had to fly high for safety as we had no emergency fields for forced landings, too high for my limited picture equipment. We used the Wright on this camera work, but meanwhile kept exhibition dates with the Curtiss. Micky decided he had been sentenced to the pilot's seat for life.

Our super attempt came one day when we flew over Chicago. High buildings and lake winds caused the air to be full of holes or pockets. But somehow we managed to bump over all right with the camera grinding, running out of film over a light house in the lake.

The title was swell, "When the sea gull looks down," but the film was terrible. The lighthouse appeared about the size of a pin head while the city looked as though it were in the grip of an earthquake.

But practice makes perfect so about the time that fair season ended I was selling films I had made to Pell Mitchell of a newsreel known as "Gaumont Mutual Weekly." We had one more date to fly—Phoenix, Arizona.

Micky flew down there with the intention of hopping to California, where I had arranged to meet him later. However, he was offered a job in Phoenix, to fly for Villa's army in Mexico on scout duty, so Micky wired me to postpone the trip to California. Then he crossed the border.

But Lady Luck evidently deserted him on this side of the Rio Grande and went up to sit on the side of a bed with Micky McGurrin. I shot newsreels all that winter in Chicago. I had not heard from McGuire but would not have been surprised had he landed on the Lake Front bringing Pancho Villa with him. That's the kind of a guy he was.

So I dropped into Beachy's office one day to see that man Bill Pickens. Bill handed me a letter and a small picture; the picture showed a crumpled mass of wings, wires and wheels, on the back of which was written, "The last of Micky McGuire," which I read, as the words ran together.

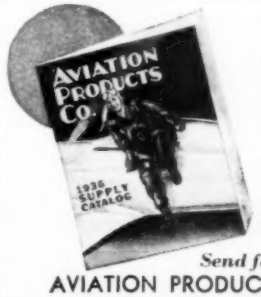
The letter was a notice that, "Micky McGuire was killed while on scout duty living only three days with the side of his face caved in." That was all, but I shall always believe that he was shot down.

For, as I told you—Micky was a flyer, a real flyer. So here's roses to your memory, Mick, the wild Irish ones to you.

We'll leave him among the sun-kissed hills of Mexico and, if you'll climb in and put on those goggles we'll hop to Grand Rapids to see Micky McGurrin. He has been battling for his life all this time and now, after thirty-two weeks, he has just regained consciousness, startling the doctors. The amazed medicos mark his case in their books, "Just one of those things."

To add the notation six months later that, "McGurrin has discarded his crutches—and a few months later, his cane." Their final entry is in 1917 when the call to arms sounded.

This notation being, "McGurrin in good health—joins U. S. Army." How he so miraculously escaped death in his fall of eighteen hundred feet remains a mystery. More so, his complete recovery.



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The ever-increasing demand in the aircraft industry for experienced men has prompted us to extend our apprenticeship training beyond our own immediate needs. We are now prepared to accept a limited number of qualified young men who are willing to pay for an education to assure their place in Aviation. 50% of tuition may be earned.

The Luscombe Airplane Development Corporation, leading manufacturers of all-metal airplanes for the private market, offer a training not only in the theoretical and academic subjects, but also in practical everyday shop problems, so necessary for a successful career. We will continue to increase our own personnel from the graduates of this apprenticeship and will also offer the industry at large trained men for the better positions in the industry. State qualifications when requesting further information from:

LUSCOMBE AIRPLANE DEVELOPMENT CORPORATION
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WEST TRENTON NEW JERSEY

Only

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REDUCED FARES

Two and a half times more people are traveling TWA, the Lindbergh Line, at new low fares. Fares as much as $36 lower than any other major airline.

- **Only TWA gives you the fastest air service from coast to coast and between every city it serves.**
- **Only TWA operates the largest fleet of Douglas Luxury Skyliners.**
- **Only TWA has an entire fleet equipped with these new aids to air navigation—"Homing" Radio Direction Finder—Anti-Storm Static Antenna, Sperry Automatic Pilots.**

For Reservations

. . . or information, call your local TWA office . . . or any hotel, travel bureau, Postal or Western Union Telegraph office.

•

SHORTEST, FASTEST COAST TO COAST

•

TRANSCONTINENTAL & WESTERN AIR, INC.

XUM

Airport

(*Continued from page 26*)

12:42 A.M., and Morse at 12:43. Estimate time of arrival Chicago 1:11½ A.M. Am 15 miles east of Morse, 4000 feet altitude. Weather clear—ceiling and visibility unlimited, temperature 68 degrees," he concludes the report.

"Chicago to Flight 12—okay," responds Al Carlson, signing off temporarily.

Al immediately telephones the above information on the inter-phone,—a line that is always open and connected with all airlines on the field,—to the men in the airway traffic room.

They have been following this plane, along with all other traffic coming into Chicago, on a huge map spread on a table. Black lines have been drawn on the map showing the various air routes, and tiny metal markers, which designate ships in flight, are interspersed along the routes. Every fifteen minutes, which is the approximate interval that the operations offices report the progress of their planes to the airways control, these markers are moved ahead.

On their backs are written the trip number, elevation of the flight, time of departure and time of arrival in Chicago. The time of arrival may change after a plane is in flight, depending on the wind. Most of this information is received from the pilot's flight plan before he takes off.

A teletype system has been installed all over the United States,—on all airports where Department of Commerce facilities are obtainable, and in all airways reporting stations throughout the country. All of these places are connected by a vast network of teletype over which information is transmitted. Weather reports are sent over teletype every hour. After all the information is compiled it is sent out in sequence. A certain time is allotted for P.X. (Ship movement reports.)

The pilots report their positions over all radio "Fix,"—that is, either the legs of the beams or the beam station itself. It is not necessary for them to see the point, as the markers are audible.

But to get back to Flight 12 on TWA. Al has relayed the information to the airways traffic control room, and they have moved the marker ahead on the map, and have written the newest information regarding the Sky Chief on the blackboard.

The plane has now progressed to within ten miles of Chicago, and the movements of the huge silver Douglas are turned over to the men in the radio room on top of the terminal building. The city radio operators, walled in by clear glass that gives them visibility in any direction, direct the air traffic on the field and in and out of Chicago.

Captain Scott tunes his radio into station WGEH, the Chicago Municipal Airport traffic control tower. To do this he switches from day to night frequency, unless he was already on night frequency, in which case he reverses things, and changes to day. This is done to leave the channels open for the regular business of the airline.

"TWA ship 325 to WGEH . . ." he calls.

Up in the control tower Mr. Becker pulls his "mike" over.

"WGEH to TWA ship 325. Go ahead."

"TWA ship 325 to WGEH—I'm ten miles west of the field. What are the surface winds? What runway shall I use—is the field clear?" Captain Scott asks.

"WGEH to TWA ship 325—winds variable, southwest 12 to 15 miles per hour. You are now ten miles west of the field—okay—field clear to come right in. Land Southwest."

Night turns into day as the powerful flood lights for landing burst into brilliancy. As the Sky Chief settles to earth its red and green navigation lights on the wing tips fade, paled by the dazzling reflection of the ground lights against the gleaming craft.

The Airways Traffic Control was instigated and installed by the airlines. Mr. Earl Ward, formerly with American Airlines, deserves a great deal of the credit. The airlines selected the men for this responsible position from their own personnel,—most of them are experienced airline pilots.

When the Bureau of Air Commerce took it over on July 6, 1936, they had an excellent nucleus of trained men. The newly established system is a clearing house for information.

The five men who hold this responsible position in Chicago are: Glenn A. Gilbert, Roland E. Sturtevant, Walter Swanson, Lee E. Warren and C. Earle Steele.

END

CORONA*

Now Eliminated

IN SPARK PLUGS

There hasn't been much said about spark plug Corona in the past as most everyone considered it a necessary evil that caused little or no trouble in engine performance. But recent discoveries have proved positively that Corona impairs engine performance, causes missing and hard starting, and also that Corona can be eliminated. . . . Now you can be assured of better engine performance by installing a set of new Champion Nocorona Mica Aircraft Spark Plugs. Champion Nocorona Spark Plugs not only definitely eliminate Corona for the first time but also bring to aircraft engines a truly gas-tight, compression-proof spark plug. Install a set of Champions in your ship and experience much better engine performance.

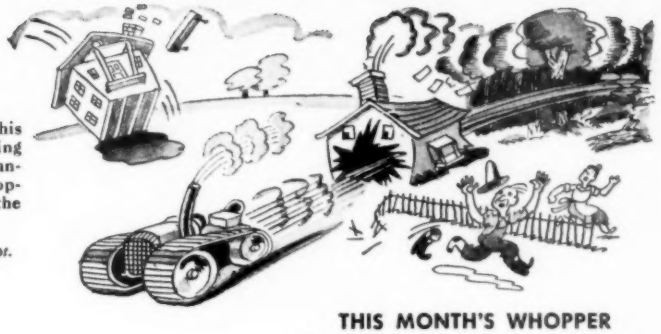
* Corona is electrical current leakage within the mica insulation and paralleling the center electrode of the spark plug. It is visible through the translucent mica core and obviously impairs the spark at the gap.

NOCORONA MICA

CHAMPION AIRCRAFT SPARK PLUGS

Contractors to the U. S. Army Air Corps.

The Birdmen's Perch



In the last Perch we had a contribution from Australia. This month there's one from England. The old page is getting around. But, to keep it *on the git* we need a load of fresh scandal—more crazy happenings—and some plain elegant whoppers. Don't let us down. Shoot a line to the Editor of the Screwiest Page on Wings.

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips", *Mgr., Aviation Dept.*
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

BILL: £5 -15 -9½ d.

Here's a reply to "P. W.'s" story (see October Perch) about the pilot who nonchalantly landed a motorless plane:

"Doubtless, 'P. W's.' test pilot was quite accustomed to having engines fall out of planes, but over here in England it is a rare occurrence. So rare, that a friend of mine was considerably startled when one of his left him, especially as an 80 m.p.h. gale was blowing at the time.

"He found himself drifting backwards toward the aerodrome as the other motor wasn't enough to take him forward. It was no use trying to land downwind, so he put his plane down backwards, in a wheel landing, and dropped his tail after a short run. As his plane had a tail-skid, it didn't run much farther.

"Although the newspapers were full of the feat, the only souvenir my friend has is a bill from the owners of the aerodrome for £5—15—9½d., being the cost of repairing the aerodrome surface."

—R. H. Ransford, The Grange, Priory Road, Felixtowe

CASTOR OIL: ITS FATE

"Is castor oil still used as a lubricant for aircraft?" writes a correspondent. The answer is, "No. A thousand times, No!"

The best oil, of course, for airplane motors is Gulfpride. This 100% Pure Pennsylvania oil is refined by the patented Alchlor process . . . a process so superior that when a mixture of six famous Pennsylvania oils (already refined) was subjected to it, 20% waste was removed from them.

COMMERCIAL AIR LINE No. 1?

"The idea of commercial air travel is no spring chicken. It's at least 120 years old Here's an article from a London newspaper of 1816 to prove it:

" 'Mr. Egg of the Strand (a German) has nearly completed a balloon in the shape of a dolphin, for the avowed purpose of carrying the nobility and gentry to Paris.

" 'It is to be made capable of conveying from 15 to 20 persons to Paris in 10 hours or less. It is worked by steam and the wings are intended to act as rudders.

" 'This scheme bids defiance to the usual exactions of inn-keepers, the customary search of custom-house officers, and all the ordinary impediments which so frequently annoy sensitive travellers.

" 'Mr. Egg is prosecuting the undertaking in a building at Brompton.' "

—G. R.

We wonder what happened to Mr. Egg. Do any of you birdmen know?

FIRST FLIGHT CHALLENGED

"There are people up here in Bridgeport who swear that the celebrated Kitty Hawk flight wasn't really the first flight after all.

"They claim that a local night watchman, who later died unsung, made several flights along the streets of Bridgeport as early as 1900." —W.T.

THIS MONTH'S WHOPPER

Gents:

I am being sued. Which it's all your fault.

Here's how come. My cow is dying on account she argues the right-of-way with a rattlesnake. Now I hear that gasoline is good for snake bites, if you rub it on. So I starts to syphon some gas out of my plane, but the fool cow don't understand. She grabs the syphon hose in her face and swallers 10 gallons of that Gulf Aviation Gasoline afore I can stop her.

This here dying critter rips out a beller and goes high-tailing across the scenery, jumping fences, ditches and small barns. All afternoon she cavorts plumb fractious that-a-way, but that night she parts with 14 gallons of milk regardless.

But the milk ain't fitten to use, not noways. It smells like gasoline. So, just sort-of experimental-like, I pours 5 gallons of this here milk into the tank on my tractor. I gives the crank a twist and leaps for my life as the tractor roars past and disappears over the hill like excaping steam.

Well, that daggone tractor never stops until it runs out of milk, which is one hour later and 75 miles due west of here. And in between is a strip 6 feet wide and 75 miles long which is plumb ruined.

If you don't help me pay the damages, I'll bring my tractor down to your place and play ten pins with your refinery buildings. Yours Truly, —H. R.

P.S.—I'm still using the blame cow's milk in my tractor. Diluted, though—one part milk to 10 parts water.

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF

GULF AVIATION PRODUCTS

XUM

Do You Know...

. . THAT the first air cooled aircraft engine was the two-cylinder Lawrence engine, built in 1914. Today the Wright Cyclone, 9 cylinders, develops 1220 horsepower. Each cylinder producing more power than most aircraft engines built in this country during the World War.

. . THAT the Wright company pioneered in practically every major development in the aircooled aircraft engine field.

. . THAT to build and deliver the first of a new model aircraft engine the costs run from $500,000 to an even $1,000,000.

. . THAT to date over 5,000 Wright Cyclones have been built, and are being used in forty-six countries the world over.

. . THAT when you fly on our leading air lines of the United States, including American Air Lines, Eastern Air Lines, Transcontinental & Western Air, Chicago and Southern Air Lines, Delta Air Lines and part of Pan-American Airways' System, you fly behind Wright Cyclones and Wright Whirlwinds.

. . THAT the longest single airline in the world, K. L. M. Air Lines (Royal Dutch Airlines), operating 9,000 miles between Amsterdam and Batavia, relies on the Wright Cyclones, built at the Wright Aeronautical plant in Paterson, New Jersey, U. S. A.

. . THAT General Chiang Kai Shek, Chinese Generalissimo, chose Wright Cyclones for his personal Douglas DC-2.

. . THAT through the medium of aircraft North America and South America are constantly being knit closer together in everlasting friendships. The cause of Peace can have no better servant.

. . AND THAT Wright Aeronautical Corporation is proud indeed of its record of service to the nation.

"Fly with Wright
the World Over"

WRIGHT
AERONAUTICAL CORPORATION
PATERSON NEW JERSEY
A DIVISION OF CURTISS-WRIGHT CORPORATION

Airy Chat

(*Continued from page* 12)

Smith: I see by the papers that Dizzy Dean came into town on an Aeronca.

Jones: That's nothing. When I was at the Yankee Stadium I saw Babe Ruth come in on a fly.

* * *

WE HEAR rumors of a new contest. This is the "One Horsepower Derby," open to all amateurs who think that they can stay off the ground for 2,000 meters with a power-plant not exceeding one horsepower. As soon as I get some definite dope on this big feature, I'll give you all the details so that you will have ample time to get out your washing-machine motor and enter the big holocaust.

* * *

TO BE the winner of the One Horsepower Derby would be a great distinction among flying men. It would be indicative of the utmost in efficiency and skill. Any dub can get off with 500 horsepower, but it takes a real genius to maintain horizontal flight with only 33,000 foot-pounds per minute available.

* * *

I WONDER where all the mass type obstruction indicators and altimeters have gone? About two years ago, the woods were full of inventors who claimed all sorts of marvels with rotating centrifuges and poised masses, but so far nothing has turned up commercially.

* * *

WE MOST certainly need something like this on our airlines to take the place of questionable radio beacons and still more questionable altimeters. We are not so much worried about our altitude above sea-level as we are about our altitude above the good hard rocks below or ahead of us. The mass-indicator, as you probably know, consists of a small weight or mass that is deflected by the greater mass of the earth below or the mass of a mountain or hill along a horizontal plane. It is theoretically a possibility.

* * *

MY MODESTY can no longer subdue the pride of authorship. I am the inventor of that Babe Ruth joke that appears a few paragraphs ahead. (Business of taking a dollar bill from the left-hand pocket and putting it into the right-hand pocket.)

* * *

N. B.M. No, we cannot use poetry. Sorry. Thanks. J.B.R.

* * *

B. F.H. Sorry we cannot use your crash story. We suggest that you send it to a newspaper. They specialize on crash stories. J.B.R.

* * *

OUT my way is an old Dutch windmill. It was put into commission in 1858 and has ground corn and wheat steadily until about five years ago. Seventy-three years of steady service without a drop of lubrication in the main bearings. Wonder when this record will be equalled by the so-called improved modern mechanical equipment. The wrought iron head shaft turned in stone bearing caps which provided all the anti-friction qualities necessary, at a speed of about 40 to 48 r.p.m. Think this over.

* * *

JUST a word with our amateur artists who, from time to time, have submitted really creditable designs for the front cover of POPULAR AVIATION.

Most of these amateurs do not understand the tremendous amount of red-tape that must be untangled before the accuracy of the cover drawings can be verified. It would be almost impossible for an individual to prepare an accurate drawing without having facilities equal to our own in gathering data.

First comes the choice of the plane. Then comes the struggle to obtain adequate photographs of the chosen plane.

KOLLSMAN FOR PRECISION

KOLLSMAN

PRECISION

AIRCRAFT INSTRUMENTS

KOLLSMAN INSTRUMENT CO., INC.
1 JUNIUS STREET, BROOKLYN, N. Y.
WESTERN BRANCH: 1224 Airway, Glendale, California
EUROPEAN DIRECTOR: Com. M. Calderara,
47, Av. de Brimont, Chatou (S. & O.) France

In some cases, it is necessary to compile the data for the preliminary sketches from several photos obtained from different sources. If working drawing and blue-prints are available, they too are requisitioned.

Now the first draft of the cover is started and, upon completion, photographs of this tentative drawing are sent to the plane manufacturers and frequently, to the Navy and Army as well, for approval.

The manufacturers make the necessary corrections on the drawings and return them to us for making the corresponding alterations which, to say the least, are frequently quite extensive. Many of the details on the original photographs are either misleading or else have since been discontinued. After months of careful editing, the cover drawing is at last ready for the lithographers.

* * *

RETURNING prosperity should show a great increase in aviation interest this summer, for the boys have more money to spend on their pet hobby. Letters requesting data on lightplane construction have been on the increase during the past few months, and if this is a sign of renewed activity, we should witness a marked improvement in flying conditions.

* * *

IT IS quite interesting to note the increasing interest in wood construction by both the amateur and commercial airplane builders. A number of laminated wood monocoupe fuselages are reported under construction in America and Europe and renewed interest is being shown in the further development of wood wing structures.

The relative advantages and disadvantages of wood and material structures have been discussed so often in P. A. that we will not open the subject again at this point, but will simply say that wood is a most excellent structural material—when properly handled—and that we await the outcome with interest.

* * *

FROM an examination of many airliner crack-up photographs it would seem that parachutes are not the only safety devices required. We believe that it would be of great assistance if each passenger were supplied with a can-opener so that he or she could cut through the metal skins of these craft before the flames reached them.

* * *

SEEMS strange that the aeronautic industry has just awakened to the merits of electrostatic shielding for their loop antennas. Metal sheeting is nothing new in other branches of radio and has been used on the Junkers ships of the Luft Hansa for a long time.

By running the wires of the loop within a discontinuous metal tube, the stray electrostatic fields are eliminated but, at the same time, the electromagnetic wave system is only slightly disturbed so that directional signals are sharper and less subject to the vagaries of electrostatic wave systems.

* * *

UNITED AIR LINES points out that, at any given time, there are never less than nine company planes in flight some place over the United States, and at certain times during the day there are as many as 20 planes in the air.

* * *

AND now, from the refineries come big tales of a new super-lubricating oil that reduces friction, wear, power loss and other undesirable factors by a full 75-percent. I wonder if this is the same oil that bobbed up about two years ago, and then dug itself back into its hole again. One great big guess. It's derived from alcohol or from the big family of aldehydes. Am I right?

* * *

ONE of our readers laments the fact that he was turned down by the examining physician on the score of high blood pressure. Don't despair, Lionel, the next horse-doctor will tell you that it is too low and that you are standing on the brink of anemia. Stop drinking coffee and don't go to the examiner for at least three hours after you have eaten. Then see what he says.

* * *

DID you know that Mary E. Mussen pretty airline stewardess flying the United Airlines run between Chicago and New York has at last settled down after being born in Chingkiang, China, and educated in Shanghai, Canada, Wheaton, Ill., and Chicago. J.B.R.

Shorty

(*Continued from page 23*)

and lubricated the mech thoroughly—with such gusto that the ship practically dripped for days from its overdose of grease. Shorty doesn't believe in doing anything halfway.

When his owner was asked how he had gone about the training of such an intelligent animal, the reply was that he hadn't been trained!

"I've merely allowed him to grow up as a normal child would, and by reasoning with him, you see today the results of his natural aptitudes. It's much better that way, for if an animal is merely trained, then he depends on his trainer to do his thinking for him."

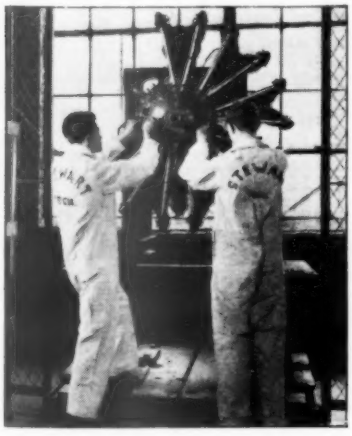
His food is somewhat specialized, though it is a sensible diet which many humans would find healthful if used. It consists of milk and raw eggs for breakfast and dinner, and fruits for lunch.

As for the luxuries of life, Shorty likes his smoke second-handed. That is, he likes to have some one else do the smoking and blow the smoke into his mouth. He then exhales through his nose. When one realizes that in this way he indubitably gets a cool smoke without a high nicotine content—well, he's not so dumb!

Recently Shorty figured something out for himself that was ingenious, to say the least. The concrete apron of the airport was very hot, and Shorty sorrowfully regarded the hundred feet back to the cool hangar where he was to rest between flights. As he was led to this haven of rest by one of the assistants, he began a pecular shuffling gait. The reason: he was carefully jumping from one shadow to another cast by the assistant as he walked along.

'Tis said that one time when no one was watching, Shorty wrapped himself around a Tom Collins—and liked it! Whether this is a characteristic inherited from some old bellicose chimp way back up the family tree, or not, is a debatable point. But his owner is very careful to keep Shorty from indulging in such dissipation. He feels that Shorty shouldn't make a monkey of himself.

END



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Stewart Tech training makes you eligible for four different Government licenses: Airplane Mechanic—Airplane Engine Mechanic—Aviation Radiophone Operator—Aircraft Radiotelegraph Operator.

Our new AIRLINE ENGINEERING COURSE covers Airplanes, Engines (including Diesels), Radio, Meteorology, Navigation, Plane Dispatching and Airline Operation. A complete technical course which prepares you for any and all Airline Ground Work. Call or write for further information about the course you prefer.

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(b) Airline Operations Course (including Radio).
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AIRPLANE AND ENGINE MECHANICS' SCHOOL

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WE OWN AND OFFER

The Following Certified Used Airplanes

Waco cabin, 1933, 210 Continental, special paint, radio, turn and bank, rate of climb, landing lights and flares—$2500.

Waco cabin, 1933, 210 Continental, excellent condition, motor just majored, landing lights—$2500.

Stinson R, 225 Lycoming, ship completely re-conditioned, motor major overhaul, radio, large tanks—$2250.

Waco 3SO J-65, landing lights, special paint, real bargain—$1500.

Trade or terms to responsible parties.

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Stinson Model U	$5,000
Lockheed Air Express	3,000
Stinson Reliant	2,800
Waco F, Warner 125, just re-covered and engine completely overhauled	1,595

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Hangar No. 3, Floyd Bennett Field, BROOKLYN, N. Y.

Telephone: Nightingale 4-4200

Watch for it!

★

BOEING YP29

—the tentative New Pursuit for the Army

FEATURED IN COLOR ON THE MAY COVER

POPULAR AVIATION 25c

Air Board

(*Continued from page 34*)

2. If there is a place for such an additional aviation trophy, for what species of aeronautical achievement should it be rewarded?
3. How should the trophy be awarded and how should the recipient be selected?
4. How in general should this trophy be best made to advance American aviation?

Randolph F. Hall wrote in as follows: "The publishers of POPULAR AVIATION deserve thanks. To best serve the purpose it would appear preferable that such award be for something new. I have been surprised to discover the number of lads in high school and college who read POPULAR AVIATION This suggests the possibility that the Trophy be an award for a contest in which only young men and women participate."

Accordingly in the discussion which ensued, it was the consensus of opinion that for aeronautical accomplishments of mature workers sufficient medals, prizes, trophies were already available; that it was the younger men interested in aviation whom it might be advisable to encourage; that the trophy or prize should go to a young man in High School or other secondary school, or in College, and under the age of 22; that the prize or trophy should not be for the mere writing of an essay or other literary effort but for some definite achievement pertaining to the advancement of aviation, whether in engineering, flying, operation or in some allied field such as the development of a new aid to blind flying for example. Beyond these expressions of opinion the meeting did not go and it was decided to solicit the help of readers of POPULAR AVIATION before deciding this question.

WILL OUR READERS HELP?

We are here and now asking the help of our readers for suggestions and help in this matter. Will readers write in *immediately* to the Chairman giving their views on the possibility of the trophy in general; the character of the achievements which should be distinguished; the method of award; the most desirable character of the award; and not hesitate to write freely and informally on any other aspect of the subject which may occur to them.

SHALL AIR REGULATION BE TURNED OVER TO THE I. C. C.?

Mr. William C. Fleming, whose well founded reputation rests in the legal aspects of aviation brought up for discussion the bill introduced by Senator Pat McCarran for transfer to the control of the Interstate Commerce Commission the functions of the Air Commerce Bureau.

It is an open secret that this bill was prompted by the general public feeling that the Interstate Commerce Commission had done a splendid job in its railway work, and was a body remarkably free from any political tinge and could be relied upon to improve aircraft regulation.

As an objection to this bill Captain Depew raised the pertinent question as to what possible concern the I. C. C. might have in the manufacture of private airplanes or in the licensing of pilots or in any phase of aeronautical activity which did not have an interstate character.

The I. C. C. could, in Captain Depew's opinion, be very well entrusted with the task of rate regulation and do this job, for which its many years of experience had rendered it particularly capable, far better than the Post Office Department. This argument is well founded since the Post Office does not only regulate rates but is at the same time a "customer" of the airlines. It puts the customer in a

THIS IS TAYLORCRAFT YEAR

DON'T BUY UNTIL YOU'VE SEEN THE TAYLORCRAFT

YOU'LL BE SORRY IF YOU DO!!

Price $1495 Flyaway Alliance

TAYLORCRAFT AVIATION CO., INC.
ALLIANCE, OHIO

APRIL DELIVERIES ASSURED

difficult position to regulate the price of the article he buys.

Casey Jones voiced the view that there was nothing fundamentally wrong with the idea of the Air Commerce Bureau performing the functions that Senator McCarran was seeking to have transferred. It was only advisable to improve the existing organization. There was no particular object in making a transfer of duties just for the sake of making a transfer. "Would it not perhaps be a case of jumping from the frying pan into the fire?"

LIVELY EXCHANGES

The meeting ended with lively exchanges of views regarding the respective merits of various bills for regulation of aviation in New York State, and with equally vivacious but less divergent argument between Ray Brown and Tommy Tomlinson regarding the value of the radio direction finder as compared with the radio beam.

END

Louise Thaden

(*Continued from page 30*)

see a great evidence of pick-up all along the line. The recent adverse publicity of the air crashes doesn't seem to have made any difference."

AFTER a long grueling cross-country trip, it's nice to curl up in a hotel room or somebody's home with a copy of "Popular Aviation." For the last two years—in which time I have been almost constantly in the air, working first for the Bureau of Air Commerce and later for a private concern, I've been reading the magazine regularly. Its stories are short and snappy and easy reading, and all very authentic.

Signed,

LOUISE THADEN.

Carbureter

(*Continued from page 34*)

The interior of the expansion tank is filled with baffle plates and the vapors are forced to follow a tortuous path around them, expanding all the way, until they are taken by a vacuum operated diaphragm pump (E) and forced into the secondary expansion tank (F). This pump forces the vapor in at a pressure of not more than ¾-ounce but if the pressure should rise higher, it is automatically passed back to a point beyond the pump through a relief valve fitted in the by-pass (G).

In the secondary tank, the vapor is under slight pressure and is forced around until it emerges as a "dry gas" through passage (H) from where it passes into the venturi tube (L) and is mixed with incoming air. No adjustment is shown here but it is secured by linking a butterfly valve in passage (H) to the throttle (K).

There you have the working principle of the Pogue Carbureter. Pogue claims his motor runs much cooler, is easier to start and will idle much slower than others. He states that pick-up is quicker and sustained high speeds are possible in the hottest weather. Delayed combustion, due to liquid droplets, is always productive of heating and carbon deposits.

The fact that Pogue claims to have increased the range of all gasoline propelled vehicles to a matter of twenty times or more is of paramount interest. It means that commercial planes will be able to carry payloads that really pay, if they still get the same rates that are in force today. It also means that sport pilots can take their ships off for a real flight without worrying about the gallons per hour angle. In all, if Pogue's claims are proven—and they seem to have been so far—aviation will benefit more than any other industry.

END

Fly "First-Class" WITH THE FLAGSHIP FLEET • New York-Los Angeles, in giant 14-berth Flagship Sleeper Planes, over the favorable all-year Southern Transcontinental Route. New York-Chicago, New York-Boston and Chicago-Washington, NON-STOP in 21-Passenger Flagship Club Planes. Also New York-Chicago via Detroit and Buffalo.

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AIRLINES INC.

Read this Letter

one of the many we have received

"Having received the last order, I am more than pleased, especially the texture of the balsa. How do you manage to sell such excellent material and yet keep the price so low? No company has yet sent me such fine materials for so low a cost. Wishing that every model builder would give your company a try, I remain, Sincerely yours.
(Signed) Loran Brunow, 334 Washington Av., Peru, Ind.

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Rockets

(*Continued from page 36*)

reached the upper part of the air, when the rocket motor would function directly to drive the craft.

In his patent No. 1,980,266, for which application was filed in 1931, the pressure of air entering the rocket combustion chamber (which pressure depends on the density of the atmosphere and the speed of the rocket craft) opens a fuel valve, so that fuel is sprayed into the combustion chamber as long as air is admitted.

When the combustion chamber is fully charged the valves at the air port are closed and the fuel valve is simultaneously closed.

Goddard has a number of other patents —perhaps more United States patents than any other inventor in this field. With twenty-seven years of devoted effort in it, he is one of the most important of the pioneers of the rocket ship.

From Russia comes word that the Soviet Union plans to send up a great rocket. In South Europe and North Africa, D. Lyon has spent much time and money in experimentation with instrument-carrying rockets.

There is thus increasing activity, competition and cooperation in this youngest of man's means of travel and exploration. When the first rocket will climb out of the stratosphere into frictionless space no man can tell. But it will come.

And we can surmise how some of the problems now facing us may be solved in that future craft.

To be free of the earth's pull the ship must shoot into outer space at a speed of about seven miles a second. As it moves away from the earth through this frictionless space its speed is steadily decreased by the pull of gravity from the earth; but at the same time this pull of gravity is itself decreased as the ship goes further from the earth.

Emerging into space at more than 6.664 miles a second the ship goes out so fast that its speed is never entirely overcome by the lessening earth's pull. For the earth's pull then lowers the speed of the ship less than the earth's pull itself is decreased, as the ship goes on out into space; and as there is no friction in space, the speed of the ship through space thus never reaches zero.

Hence, the relatively simple problem of sending a rocket to the moon without a return trip is nearly solved when the rocket is shot into outer space toward the moon at a speed of about seven miles a second.

This speed of seven miles a second, however, must not be reached until the craft is about to enter frictionless space. In the air the friction on an uncooled craft would tend to burn it up as most meteors coming to earth from outer space are burned by our 250-mile envelope of air.

It is possible that in the future some practical means of cooling the outer shell of a rocket going at tremendous speed in the atmosphere may be designed. But the most practical present solution of this problem seems to be to lift the rocket slowly through the air, and just on the edge of the void to increase its speed to more than 6.664 miles a second.

The rocket motor does not function efficiently at the speeds of airplanes. How then shall we move a rocket ship slowly up to the stratosphere, before propelling it on out at the necessary high speed?

Goddard proposes to do it by his turbines driven by rocket-gas.

In the opinion of the writer a simpler way would be to lift the rocket up to or near the stratosphere by a balloon (or balloons), and from the upper limit of the balloon's travel to discharge the rocket, which thus would not need to carry much heavy and expensive fuel. The rocket-supporting balloon should be especially designed for its purpose—perhaps with a recess or hole in its center in which a frame held the rocket or rockets.

In the opinion of the writer this system of rocket propulsion would avoid much of the expense and complication of problems encountered to date by most of the pioneers who have sent up instrument-carrying rockets. If any experimenter wishes to make use of the idea he is welcome to do so.

The rocket must be stabilized in flight. Its direction must not be changed due to shifting of its center of gravity by the burning of its load of fuel. A bullet is rifled to cause its rotation and stability in flight, but a rocket can not be so rotated as it is not fired from a rifled barrel. As Goddard, Oberth and others pointed out, a gyroscope inside the rocket centered on the line of flight is the best means for solving this problem of stability.

To reduce dead weight the rocket should consist of several telescoped sections, each section being a rocket motor with fuel, combustion chambers and exhaust tubes; and after its fuel is used the remainder of the section is dropped. This type of rocket is called a step rocket; it basically was invented by a Colonel Boxer in the Nineteenth Century; Robert Goddard has several patents on various forms of it.

To steer the rocket the exhaust tubes at its rear should be placed at various angles or capable of movement in different directions; and when movement of the rocket toward the right is desired the propelling gases will be discharged toward the left, and vice versa.

For slow landing after a flight either autogyro blades of the type devised by Tiling should be utilized or a small balloon with metallic case, as suggested by the writer in the first article of this series, should be made integral with the rocket.

Most of these and many other immediate problems have yet to be worked out satisfactorily in practice. And before the rocket can carry man into outer space a number of other problems concerning the adjustment of earth-accustomed man to the conditions of that space—such as the provision of artificial gravity in the craft—must be solved.

The first practical uses of rocket craft probably will be in the launching of gliders, small planes and heavily loaded aircraft, the rotation of the vertically lifting screws of helicopters, the propulsion of planes through the stratosphere, and the lifting of scientific instruments into and above the stratosphere.

Much later than these things will come the transport of man, perhaps in search of treasure, material as well as intellectual—to the moon and Mars and Venus.

Modern folks, in spite of the great progress made by science in their own times, still smile when we speak of interplanetary exploration, but it is the belief of many men, well versed in astronomical subjects —that such a thing is entirely possible and even probable.

Then will adventurous exploring men push out into the vast ocean of space that awed their fathers, going with enthusiasm in their eyes to the strange worlds—worlds that they and their children will conquer for the glory of their kind—for the advancement of man of the earth.

END

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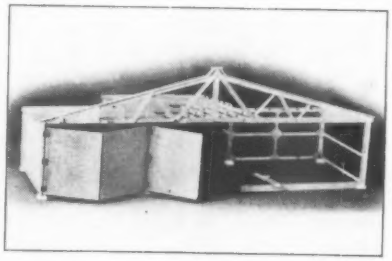

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Sydney Pickles

(*Continued from page 26*)

on fire. None of us ever got near a Zep with this equipment (which was fortunate for us) as the Zeps were faster than was realized at the time.

However, Flt. Lt. Warneford, a pupil of mine when Instructor at the Royal Naval Flying School at Eastchurch, England, succeeded in bringing a Zep down in Belgium with a Lewis machine gun fitted to a Morane monoplane, which was faster than the Bleriots.

This was also before the days of incendiary bullets and Warneford told me how he flew up and down raking the top of the Zep with ordinary bullets. This Zep had no machine guns mounted on top but which were fitted immediately after this affair.

It crashed through loss of hydrogen. On this flight, Warneford was forced to land behind the enemy lines, but after clearing a gas line he managed to dope the Le Rhone motor with the tank filler cap, started the motor himself and just get away as enemy soldiers were entering the field.

He was awarded the Victoria Cross for this victory.

This fine fellow was unfortunately killed shortly afterwards testing a new machine in Paris.

I often wonder how many of the old pilots, who, like myself, learned to fly in 1912 or thereabouts, are still actively flying and have a current Commercial Pilots license, as I have. My original 1912 British R. Ae. C. certificate being No. 263 which I was awarded on my 18th birthday, having passed the tests several weeks before. In 1913 I obtained my R. Ae. C. Superior Brevet No. 8. In 1919 I obtained British Commercial Pilot's license No. 9 and in 1928 I obtained my Canadian Commercial Pilot's license No. 266, which is in good standing over twenty-four years after learning to fly.

Speaking of old times, it may be of interest to mention that I was actually the first pilot in the World to loop the famous Jenny and that was at the Chingford Royal Naval Air Service Station near London, England, in 1915. This can be confirmed by Mr. Lyman J. Seely, the Curtis representative in England at that time, who, the day before I looped this machine, cabled Buffalo inquiring if the JN4 had been looped. This was done to silence many critics who said it would collapse if it were looped. The strength of those Jennies is now history. It was not much of a feat in the light of subsequent stunting on these machines.

It was in this Jenny that I took Earl Dougherty, the American pilot, up as my passenger for the first loop he had ever made. This was at Hendon near London, England, in 1915. Mentioning Earl Dougherty, who was killed in California, barrel rolling, a few years ago, brings to my mind the large number of excellent pilots I have seen pass from this world. Clifford B. Prodger, another excellent American pilot, also made his first loop, as my passenger in this Jenny. He also has passed on, being killed flying in California after the War.

The American pilots "Garge" Beatty, W. L. Brock, Earl Dougherty and Cliff. Prodger were particular friends of mine and I feel fortunate in numbering such fine fellows among my friends.

In a recent copy of the English "Aeroplane," dated July 13, 1936, page 19, reference is made to my aerobatics on these Jennies, although the time mentioned is a trifle out as it was in 1915.

In 1920 I carried out a Gov't aerial survey flight into the interior of Australia, using an old Jenny, which was the first aeroplane to cross the State of New South Wales into South Australia.

Before closing this letter, I must take the opportunity of heartily congratulating your paper on the eminently sensible article by Mr. John B. Rathbun on "The Waste and Uselessness of Air Races" in your October issue. As a pre-war Pylon racing pilot at London, England, who raced with, amongst others, the well known American pilots George Beatty and W. L. Brock, I heartily agree with every word in the article.

Having indulged in a lot of aerobatic flying, in my younger days, and having reached forty-two years of age (more or less in one piece), I now realize the harmful effects stunting as a whole has had on the aircraft industry. My present ambition is to be one of the oldest pilots actively flying and I consider persistent stunting and racing is the surest way not to realize that ambition.

You are at liberty to publish the contents of this letter in any form you wish, if you think it may interest your readers, as coming from a pre-war and post-war barnstormer. I hope such publication will be the means of reviving old acquaintances in the aviation game.

I am enclosing a copy of a programme used in connection with my barnstorming in Australia in 1920, which you may keep.

Yours truly,
SYDNEY PICKLES,
A. F. R. Ae. S.

Art Smith

(*Continued from page 28*)

received by royalty. Many medals were bestowed on him for his daring.

During the World War Art Smith taught flying at McCook Field, training many of our early war flyers. Later he went into the government air mail service. On his schedule run from Chicago to Cleveland in February of 1926, his plane was found burned near Montpelier, Ohio. Art Smith was the second pilot to be killed in the night air mail since it was first established in this country.

END

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Crashing

(*Continued from page 46*)

is a safe rule to follow. Faulty design and irregularities of flight nearly always show up as soon as the ship is in the air. This point was well demonstrated at the California State Fair this past September. With over thirty rivals on the field all but one of the eight major crashes was effectively photographed from the take-off position.

The first accident came when a plane, after zooming up about seventy feet banked into a tight spiral and descended under full power until a wing tip touched the ground. The result was a cart wheel. Two ships rammed their noses into the earth as they sped down at sharp angles. Another strung itself up in telephone wires. The best crash of the day took place when a fast, low-winged model looped at thirty feet, made a vertical power dive to smash into a million tattered shreds.

Shots taken while ships are in flight are interesting too. Harder to get than the take-offs they provide the opportunity to capture the sheer beauty of a plane against the sky. Such shots make perfect scale model photography, for the camera catches nothing but an occasional cloud for background. Crash possibilities here are lowest of any time during the flight but they range from falling leaf to fire.

A very neat "in flight" film resulted recently when a spark from a loose connection set fire to a red and orange "Monocoupe." It burned for several moments under full power, black smoke trailing out behind.

Even after the motor stopped it glided on and only began to fall as most of the fabric burned off a wing. Fortunately, the camera was loaded with natural color film. Ordinary black and white does not do justice to a highly colored ship falling in flames.

Crashes on the landing end of the flight usually are minor. Noseovers, side slips, broken gear, ground loops. But they are the hardest to film. The ships land at speeds up to thirty-five miles an hour and even if a car is used they often veer off with the wind at the last moment leaving the photographer framing a mere speck on the horizon.

Models, when landing, often do some very human things. One time at Mather Field, an abandoned Army airbase near Sacramento, a "Stinson," flying farther than had been expected, headed for a temporary lake formed by the spring rains. When it became perfectly apparent that it should have been equipped with pontoons, it suddenly banked around in a sharp turn and settled gently on the shore within three feet of the water's edge.

Another time, when flying a brand new black and yellow monoplane over a terrain thickly spotted with patches of murderous sage brush, it was thought extremely uncanny, when at the end of each of seventeen consecutive flights ranging from five hundred yards to a mile and a half, it carefully selected a clear spot on which to land. Awe reached its acme however, on the last flight when the plane, landing fast, was headed, just before the gear touched the earth, for huge solitary sage.

The photographer expected to see, through the finder of the camera, a minor landing crash and pressed the starting button. What did happen was almost unbelievable. When this scene appears on the screen the ship strikes the ground hard just in front of the bush, leaps lightly over it and makes a perfect three point landing on the other side.

Model builders and their ships now can be found at every major airport. If you really want to make some pictures most any builder will be glad to co-operate—if you promise to let him see the finished film. The International Gas Model Airplane Association continually is holding meets in different sections of the country.

Nearly every state fair now has its gas model flights competition. Some county fairs too. Besides these are the private meets where from two to ten enthusiasts convene to pit their craft against that of a brother in the sport. Generally speaking it is easier to make good movies when attending an unofficial meet of a few ships or when out with a single model and its pilot. Excitable people rush after the planes on a crowded field, get into the picture and spoil the scale model effect.

One of the latest developments in this field is the "Dawn Patrol." It consists of a conclave of ships and pilots in the still air of the dawn from the first streaks of daylight until the wind comes up.

One interesting addition, it is expected, will soon be made to the color film collection. It will be a Dawn Patrol taking off in mass formation. The ships won't fly that way long and they won't land within a range covered by three-quarters of the compass but at any other time such an idea would be ridiculous. The flight, at least, will have a Chinaman's chance in still air.

The flare of bright colors, the crash or two that will occur by reason of locked wings or a fast ship nosing into a slower one (although precaution will be taken against this hazard) or a lead ship throwing a tantrum and stacking up the lot, will indeed be a prize bit for the record.

END.

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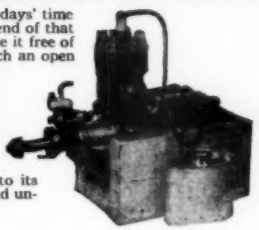

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It is the modern miniature motor designed exactly as present day real motors and has broken records for amazing performance. And look at the reason! In many cases we could have saved considerable money using inferior weak parts. Examine each part closely. Look at the life-time high-speed bronze connecting rod—and the crank shaft ⅝" thick as compared to other motors selling at twice the price having a thickness of only ⅛". Then, too, G. H. Q. has one of the largest crank shafts on any motor—as well as the fool-proof long-life timer. And look below for 24 extra, exclusive features!

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The G. H. Q. Motor is priced especially low so that you may deal direct with our factory. Even though dealers have asked to handle this product, we have not been able to give them a special dealer's price. This famous motor, complete, entirely assembled on stand, tested and run before shipment, performance guaranteed. No oil, gas or batteries included. Postpaid for only..... **$12.50**
Free—one finished flywheel mounted on motor with every finished motor.

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Here is your opportunity to obtain a kit of this famous motor. Easy. Assemble it yourself and save money.

Everything is in the kit, including plug, coil, condenser, tank, ignition wire, cylinder, piston, connecting rod, timer, crankshaft, all screws, nuts, bolts, etc. No oil, gas, batteries, or propeller included
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"We warrant each new G. H. Q. gasoline engine manufactured by us, to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at our factory, any part or parts thereof, which shall, within ten (10) days after delivery of such motor to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction, to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our G. H. Q. gasoline engine."

24 Extra Features!

1. Easy to start.
2. Steady running—as long as gas, oil and spark are supplied.
3. Motor cannot overheat.
4. Precision parts.
5. All parts replaceable.
6. Cylinder and piston lapped.
7. Accurate die castings.
8. Crank shaft balanced and perfectly machined.
9. A light spark coil that is oil, water and gas proof.
10. Coil will not overheat or shortcircuit.
11. Main bearing is high-speed bronze, ground and lapped to size.
12. Condenser is gas, oil and water proof.
13. Cylinder and piston inspected cast iron to insure long life.
14. Chrome nickel steel shaft with 1⅛" bearing surface.
15. Connecting rod of high speed bronze.
16. Carburetor assembly accurately designed and made.
17. Needle valve and valve body machined together.
18. Breaker assembly compact, fool-proof, long wearing, replaceable and adjustable.
19. Easily inverted and runs in either direction.
20. Motor starts and runs on 2-ounce battery.
21. Speed range 500 to 10,000 R.P.M.
22. Low gas consumption — runs 27 minutes on one ounce of gas.
23. Strongest miniature motor.
24. LOWEST PRICE EVER SET.

The G. H. Q. Motor was on exhibit at the National Aviation Show where thousands of visitors praised its performance.

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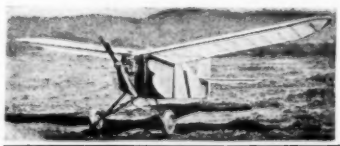

The G. H. Q. Sportster kit especially designed for G. H. Q. Gasoline Motor but may be used for any other motor of like weight and power. Built according to scientific aerodynamic principles—Has made hundreds of successful flights without crackup—Marvelous glider . . . And what a climber! A complete kit of all parts including plan, all wood, wire, wheels, metal and all other parts. Postpaid for only..... **$5.00**

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These are the giant models that have amazed the model builders of America. Imagine strong outdoor flyers that are actually ⅓ the size of passenger carrying planes—a $10 value for only $1.00. Everything is in the kit including all liquids—nothing else to buy!

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G. H. Q. MODEL AIRPLANE CO.

854-P East 149th Street
NEW YORK, N. Y.

ZMC-2

(*Continued from page* 30)

had and would be used. (3) Of still greater import is the fact that, in the building of such a ship, it must not be overlooked that the total seam weight also decreases, inasmuch as the larger the ship the larger, thicker and wider the metal sheets are rolled.

The ZMC-2 in its eight years of service, has clearly proven to the skeptics, who predicted she would not be able to stand engine vibration and that her metal covering would corrode and a host of other lesser reasons, that they were badly mistaken. In regard to corrosion there is none and in comparison to fabric ships of similar size its gas loss through diffusion is 50 percent. less. Visionary opinions, having been replaced by scientific facts, the next commonsense step in the light of what happened to our other Zeppelin type fabrics would be to build a large metal clad.

It is ironic that the Wrights had to go to England to gain not only support but the recognition we were so long giving for their pioneering of the first successful heavier-than-air craft. History repeated itself when Carl B. Fritsche, of Detroit, jointly responsible for the building of the ZMC-2 stepped before the Royal Aeronautical Society of London on May 14, 1931, and delivered an address that was later published in book form by the Society.

In beginning his address Mr. Fritsche said, "A sort of unselfish and patient willingness, which encourages men to depart from beaten paths and invade unknown realms to bring forth something new and beneficial to society, is indispensable to any new enterprise, and most characteristic of those who are pioneers in airship development. Certainly none so far have garnered any substantial profits.

"But it is no reflection upon their intelligence if they have the fortitude to carry on the task, triumphant over the normal instinct for immediate profit. 'Intelligence always stretches forth welcoming arms toward the new and little known, while instinct wraps its legs around the venerable and tried, and endeavours not to budge.'

"It is not characteristic of mankind to give up in the face of temporary defeat. Research and experiment broadening the horizons of knowledge must continue. The final victory is a monument to the fallen no less than to those who have triumphed. Their sacrifice is a living challenge to carry on the task they have regretfully laid down until ultimate success is realized."

THE SUCCESSFUL RIGID AIRSHIP HAS BEEN WITHIN OUR BORDERS FOR NEARLY A DECADE.

Meanwhile we were imitating the Zeppelin type which inflated with hydrogen had proven a success for the country of their origin, but when inflated with the safer helium possessing 8% less lift had proven as far as the United States is concerned that they were not our type.

Dr. William Hovgaard, for many years a Professor of Naval Design and Construction, Massachusetts Institute of Technology and also consulting engineer to the U. S. Navy on submarine and airship design gave the following expert opinion which was recorded in Mr. Fritsche's book, The Metal Clad Airship.

"The metal skin plays about the same part as in the strength hull of a submarine, where the shell plating forms at once a water-tight envelope for the inner hull capable of standing pressures and a girder as well. This feature, together with the internal structure, serves to resist longitudinal bending and transverse shearing.

"The metallic skin, in conjunction with the rigid frames and a high gas pressure, insure a maintenance of form not obtainable in the Zeppelin type where the diagonals permit great shearing deflections.

"The conventional bending theory which is used in calculating the longitudinal and shearing stresses applies with greater accuracy to the metal clad than to the Zeppelin type so long as the air pressure is maintained as assumed.

"The fact that a high internal pressure can be safely maintained is one of the most important advantages of the metal clad. Associated with a rigid structure, the metal clad skin places this new type of airship in a class by itself, superior in strength and stiffness to all former rigid and non-rigid airships. It excels by its simplicity."

In other words the building of a metal clad dirigible, as in a submarine involves primarily the economic disposition of materials. This fact was very clearly shown in the same book by Dr. Herbert C. Sadler, Dean of Engineering, University of Michigan and also Professor of Naval Architecture and Marine Engineering:

"A fundamental factor which tends toward the most economic solution of a problem, is the disposition of materials of construction so that if possible they may perform more than one useful function.

"From time immemorial, this has been a recognized fact in ship construction, where the hull of the ship is designed not only to give the necessary strength to the structure, but also to keep the water out and give the proper shape to fulfill the conditions of speed and carrying capacity.

"In the case of an airship, the same philosophy is sound, in that from aerodynamic conditions we must have a certain streamlining factor.

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Construction Set complete, postpaid **$4.50**

41" LOCKHEED ARMY SPEED VEGA

41" Span. Length 28". Weight 8 oz. 1" Scale

This new model, built very strong yet light in weight, is practically crashproof and will out-perform any large scale model built. Rises from ground in 10 feet and flies over 650 feet. Set contains all parts printed on balsa, ready cut pant cores, 4¼" turned motor front, 11" steel type carved paulownia wood propeller, 2½" balsa wheels, tail wheel, formed wire parts, 26' rubber, 3 oz. yellow dope, 2 oz. blue, ⅛ oz. black, 2 oz. glue, cement covering, full size scale drawing, and all parts.
Construction Set complete, postpaid **$4.95**

NEW BOEING P26A ARMY FIGHTER

22" Span. Length 17½". Weight 2½ oz. ¾" Scale

Above photo shows finest equipped model of this plane on the market. Having ready made motor, cowl, prop, etc., it is very easy to build and is a beauty. Const. set contains 3" celluloid motor, 3¼" spun tapered aluminum cowl ring, 8" steel type paulownia wood prop, 1⅝" celluloid wheels, tail wheel, insignia, windshield, instrument board, 1 oz. yellow dope, 1 oz. blue, cement, glue, all parts printed on balsa, and drawing.
Construction Set in labeled box, postpaid **$2.75**

NEW LOCKHEED P24B ARMY FIGHTER

32" Span. Length 20½". Weight 3½ oz. ¾" Scale

New scale special detailed model, equipped with 2" pneumatic rubber tired M. & M. air wheels. Set also includes ready made and painted pilot's bust shown, 2 aluminum step plates, 9" carved steel type prop shown, all parts printed on balsa, turned balsa motor front, 3 oz. colored dopes, paper cement, 2 oz. glue, covering, colored insignia, formed wire parts, nose plug with brass bearing, rubber, 9 metal motor exhaust pipes shown on cowl, full size scale drawing, and all parts to build.
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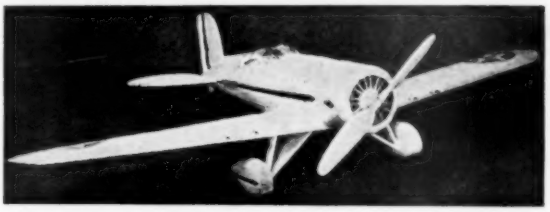

COMBINATION LAND AND SEA PLANE SET

32" Span. Length 20½". Weight 3½ oz. ¾" Scale

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc., printed on balsa, a 3⅜" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop shown, 3 oz. silver paint, 1 oz. cement, ½ oz. black, 2 oz. glue, ready cut wheel pants, strong 2" aluminum wheels, 12 feet of rubber, and large 33"x44" drawing of land and sea plane. This is a sensational model and only one of its type in the world.
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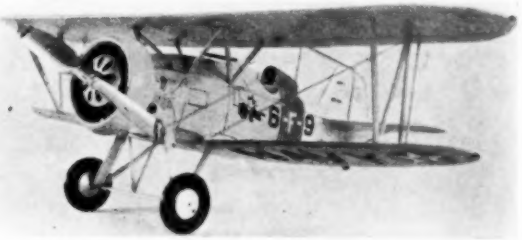
New Improved Detailed Model



22½" Span. Length 14½". Weight 2½ oz. Color, Grey, etc.

This is the finest equipped Boeing, F4B4 model in the world. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished steel type propeller, printed out balsa wood parts, 2 oz. grey dope, ½ oz. yellow, ½ oz. red, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ¾" scale drawing. **Construction Set complete, postpaid** **$2.95**

NEW NORTHROP FT1 NAVY FIGHTER

22" Span. Length 15". Weight 2½ oz. ¾" Scale

A beautiful flying model of the latest Northrop 280 m.p.h. fighter. Set contains 3" turned motor front, 8" carved propeller, insignia, silver, black and clear dope, glue, all parts printed on balsa, full scale drawing, and all parts to build as shown.
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LOCKHEED R20-1 NAVY ATTACK

27½" Span. Weight 3½ oz. Color, Silver, etc. ½" Scale

Model is fully detailed with authentic wing rib and body stringer spacing. Every air-minded boy will want this powerful-looking model. Motor power is run through the fuselage and is concealed—a special exclusive feature.

Set contains 2 standard steel type carved wood propellers, 16" rubber, star and rudder insignia, all parts printed on balsa, 2 turned balsa motor fronts, balsa air wheels, silver dope, black, glue, full size scale drawing, and all parts to build. **Construction Set complete, postpaid** **$2.95**

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China

(*Continued from page 25*)

will come within the next three years, Colonel Jouett says, and if the Chinese can delay it until the end of that arbitrary period, they have an excellent chance of not only successfully resisting the attack of one of the world's most powerful military machines, but there is a possibility that they could conduct a highly offensive war.

In addition to his first line of defense, the air force, General Chiang is quietly building up a huge army. Far back in the interior—so far back that only rumors of the activities have filtered down to the coast—it is said that five hundred thousand men are being trained to the utmost efficiency by former German officers, and that they are being equipped with the latest type rifles, machine guns and other implements of warfare. These forces have not been used against any aggressors, internal or foreign; they are being "saved" for the Japanese when the real war comes.

The Japanese realize what the Chinese dictator is planning for them, Colonel Jouett thinks, and are now trying to break China into sections which cannot offer successful resistance individually.

General Chiang knows that war is inevitable, but is trying to delay it by making small concessions until his army and his air force have been built up to the necessary strength.

"Unfortunately," Colonel Jouett said, "Chiang Kai-Shek may be unable to delay war until China is completely prepared. If he can delay it, which is exactly what Japan doesn't want him to do, China has a good chance of winning. However, it looks now as if hostilities may come at any time."

If they do come now, or if the war doesn't begin for another year or so, it is virtually certain that Sino-Japanese hostilities will offer the first real test of modern aerial warfare. The present civil war in Spain is not a true test of bombers, at least; Glenn Martin himself said just the other day that pilots of neither side are provided with the equipment for scientific bombing, nor are they trying to do so. They merely are flying across the opposite force's lines, and dumping their missiles without apparent aim.

Returning to China and its plans, the Japanese correctly interpreted the danger to themselves of permitting an experienced American pilot to help the Chinese in their aims. Not only did they complain bitterly to the League of Nations when he and his assistants were hired, but they conducted an undercover campaign against him during the entire period of his association with the Chinese government, it is said.

When his contract expired late in 1935, it was not renewed. It was the consensus of opinion among informed persons at that time that pressure had been brought to bear by the Japanese on Chiang Kai-Shek so that it would not be renewed.

So Colonel Jouett returned to the United States and joined the staff of the Fairchild company. But China has not suffered greatly from his absence, because he left the air school in good shape. Four of his young American instructors remained at the school, Chinese whom they taught to fly under his supervision are now acting as instructors, and the work of turning out first class fighting pilots is proceeding merrily on its way. In fact, two hundred and fifty pilots are being graduated from the school each year, and the Chinese people have become so enthusiastic about their new air force that recently, on the dictator's birthday, they raised a huge sum of money and bought him new airplanes as a gift.

When war comes, as it most inevitably must, American airplanes flown by American-trained pilots surely will bomb the great industrial centers of Japan, which are known to be highly susceptible to attack from the air, within a few hours of the declaration of war. Apart from its horror as war, it will be an interesting example of just what are the capabilities of the modern fighting plane.

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1/16x1/8 ..... 35 for 5c
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1/16x1/4 ..... 15 for 5c
3/32x3/32 ..... 30 for 5c
1/8x1/4 ..... 12 for 5c
1/4x1/4 ..... 8 for 5c
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18" BALSA PLANKS
1x1, 1 for 4c
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For 36" lengths double above prices and add 10c postage

15" BAMBOO
1/16x1/4 . . 6 for 5c
Shredded . . 40, 5c
Japanese Tissue All colors, Dz. 18c
Silver or Super-
ALUM. LEAF, 2 sheets for 1c
WIRE, 6 ft. 3c

fine Tissue . . 5c
Doz. 50c
Thinner Best
1 oz. 5c
Sheet Celluloid 2x6 ..... 2c
36" lengths.
NOSE PLUGS, large . . 10c doz.

6x8 ..... 4c
12x16 ..... 15c

Clear Dope
1 oz. 5c
1/2 pt. 25c
1 pt. 45c

Colored Dope
1 oz. 5c
1/2 pt. 30c

Clear Cement
1 oz. 5c
1/2 pt. 25c
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Wood Veneer
20x30", 1 for 9c
2 for 17c
Reed
1/32, 1/16"
..... 3 ft. 1c
1/8" ..... 3 for 2c

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3/4", pair . . 2c
1", pair . . 4c
1 3/8", pair . . 4c
1 3/4", pair . . 7c

Celluloid Wheels
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1", pair . . 7c
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1 1/2" Diam . . 14c
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SPOT WELDED HOLLOW ALUMINUM WHEELS
1" ..... pr. 6c
1 3/8" ..... pr. 11c
1 7/8" ..... pr. 14c

Sheet Aluminum .003 . . . sq. ft. 10c
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1/16", 3/16", 1/4" . . . . 10c ft.

Thrust Bearings . . . 1c
Bushings, doz. 3c

ORDERS 75c or under 15c postage. Postage prepaid on orders over 75c. West of Mississippi add 10c extra. Canada: add 15c extra on orders under $1.00. On orders over $1.00 add 15%. CASH OR MONEY ORDER—NO STAMPS —NO C.O.D.'s.

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at a price everyone can afford

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16" Wing Span

50c *10c Postage* **REARWIN SPEEDSTER**

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THE NEW SELLEY-TEX "MOTH"

ALL FINISHED MOULDED ASSEMBLY KIT

22" Wing Span

GUARANTEED TO FLY 200 FEET

Check these 10 Advantages Selley-Tex Offers Over All-Balsa-Stick-Kits

1—HOLLOW MOULDED CONSTRUCTION.
2—EASIER TO BUILD.
3—PRACTICALLY CRASHPROOF.
4—MORE AUTHENTICALLY DESIGNED AND DETAILED.
5—POSITIVE MEANS OF BALANCING.
6—BETTER FLYERS.
7—SUPERIOR FINISH.
8—NON-COMPETITIVE.
9—PATENTED.
10—UNCONDITIONAL FULL MONEY BACK GUARANTEE

EVERY SELLEY-TEX KIT CONTAINS

The necessary moulded fuselage shells, cowl, pants parts, bombs, motor, etc. Sawcut propeller, scale propeller parts, formed wire hooks, scaled wheels, brass bushings, printed cut ribs on balsa, turned wood parts, tail wheel fork fittings, wire, para rubber motor, colored paper, authentic markings, colored insignia, cement, colored dopes and easy to understand plans, all are packed in a beautiful sturdy box.

SIMPLE AS A. B. C.

A—Fit together and cement the two moulded parts of the fuselage.
B—Cut away the border of excess fabric.
C—The result is a perfectly shaped fuselage in the form of a hollow shell, very strong and indestructible.

Send 5c. for catalog of Airplane Supplies. 5c for Boat Catalog.

● WHAT IS SELLEY-TEX? ●

SELLEY-TEX is a finely woven processed fabric, moulded to form stiff hollow shells reproducing in perfect detail, fuselages, cowls, motors, pants, etc. It is half as light and twice as strong as any balsa model with the same amount of detail.

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Wide-awake merchants will appreciate the tremendous sales appeal of these new competitively lower price SELLEY-TEX kits. CASH IN on these exclusive sell-on-sight sensations. Write today for complete information, discounts, etc.

This trim, graceful new SELLEY-TEX sensation is a modified design of the famous English "DeHAVILAND-MOTH" and is the most beautiful flying model ever produced. FOR THE FIRST TIME, since the inception of MODEL Building SELLEY has accomplished that which has been the goal of all model manufacturers. HERE AT LAST—is a super quality model that is scientifically designed and aerodynamically perfect that will give amazingly long flights, either from the hand or off the ground. The method of construction and new uses of materials are entirely novel and new in model airplane building. All parts of the Moth are beautifully moulded in the form of light hollow shells, perfectly shaped and fully detailed. The fuselage shells are firmly fused together forming a perfect, crashproof fuselage. All wing surfaces are moulded to the correct wing curves and are completely finished. The moulded hollow streamline struts are remarkably strong when cemented together. The "MOTH" when assembled is practically crash proof and will stand up under the most severe flying punishment.
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ASK YOUR DEALER—if he can't supply you send direct $1.50 plus 15c postage.

FINEST QUALITY MODEL AIRPLANE SUPPLIES AND ACCESSORIES

PROPELLERS

Hawk Type

2-bladed		3-bladed	
3½"	25c	4"	35c
4"	30c	4½"	45c
4½"	35c	5"	50c
5"	35c	5½"	60c
5½"	40c	6¼"	70c
6¼"	40c	7"	80c
7"	65c	8"	90c
8"	65c	9"	$1.00
9"	75c	10"	1.10
10"	85c	11"	1.25
11"	95c	12"	1.50
12"	$1.10		

DIE CAST

2-bladed		3-bladed	
1½"	8c	1½"	10c
2"	10c	2½"	12c
2½"	10c	4"	25c
3"	15c	4½"	35c
4"	20c	5"	45c
4½"	25c	6"	60c
5"	30c	7"	70c
5½"	35c	8"	80c
6"	40c	9"	90c
6½"	45c	10"	$1.00
6¾"	50c	12"	1.25
8"	60c		
9"	70c		
10"	80c		
12"	$1.00		

Standard

3-bladed	
1½"	10c
2½"	12c
4"	25c
4½"	35c
5"	45c
6"	60c
7"	70c
8"	80c
9"	90c
10"	$1.00
12"	1.25

Props can be had up to 24 in. dia. Postage 6c each.

FINISHED—POLISHED ALUMINUM PROPS.

15"	$6.00	15"	$7.00	15"	$5.00	15"	$6.00
18"	7.00	18"	8.00	18"	6.00	18"	7.00
21"	8.00	21"	9.00	21"	6.50	21"	8.00
24"	8.50	24"	10.00	24"	7.00	24"	8.50

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Die Cast New Guns

WITH RING MOUNT
1¼" long B 25c
1¾" long A 30c

SWIVEL TYPE GUNS C
2" Double Action 15c

PURSUIT TYPE GUNS D
⅝" long.... 5c
1" long.... 5c
1½" long.... 5c

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1¾" long.... 10c

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1¼" long 10c

G DUMMY RATCHET GUN
⅞" long 5c
3c Postage

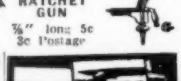
13/16" 5c
1¼" 8c
3" Torpedo. 15c

DUMMY MOTORS

Something New
9 Cylinder
1" dia. 30c
1½" dia. 50c

Spun Aluminum COWLS

	Drag Ring	Open Face	Closed Face
1"	.15	.15	.15
1½"	.18	.18	.18
2"	.20	.20	.20
3"	.28	.28	.28



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24 ARMY	25c Set
18 NAVY	25c Set
16 WARTIME	25c Set
81 SQUAD. INSIG.	25c

CELLULOID MOTORS Postage 3c

Separate Cylinders		Celluloid Dia. Motors		Aluminum Cowl Plates		Celluloid Motor&Cowl Combinat'n	
5/16"	3c	1½"	15c	⅞"	8c	1½"	18c
⅜"	4c	2"	18c	1⅛"	10c	2"	20c
½"	5c	2½"	20c	1¾"	12c	3"	30c
		3"	25c				

WHEELS

SEND 5c FOR CATALOG

Aluminum Disc Rubber Tired Wheels

½" dia.	5c ea.
⅝" dia.	6c ea.
¾" dia.	7c ea.
⅞" dia.	8c ea.
1" dia.	9c ea.
1¼" dia.	10c ea.
1½" dia.	11c ea.

Balloon Tire Alum. Disc Wheels

1½" dia.	25c pr.
1¾" dia.	28c pr.
2" dia.	30c pr.

Treaded Rubber Tire Aluminum Disc

1 3/16" dia.	30c pr.
1½" dia.	40c pr.
2" dia.	50c pr.
3" dia.	60c pr.
5⅝" dia.	$1.50 pr.
6½" dia.	$2.00 pr.
7" dia.	$2.50 pr.

Axle Fork and Swivel Joint

⅛ up to ⅝" wheel 10c
¾ up to ⅞" wheel 15c

Aluminum Disc Rubber Tired Air Wheels

1" dia.	15c pr.
1¼" dia.	18c pr.
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Celluloid Wheels	Balsa Wheels
⅜" dia. 06c pr.	04 pr.
1" dia. 08c pr.	05 pr.
1⅛" dia. 10c pr.	07 pr.
1⅜" dia. 18c pr.	10 pr.
3" dia. 35c pr.	35 pr.

Balloon Tired Celluloid Disc Wheel

1½" dia.	30c pr.
1⅝" dia.	33c pr.
2" dia.	35c pr.

AXLES Threaded and fitted with washers, bushings and nuts.

Lengths	1/16	3/32	1/8
2"-5"-6"	.12	.10	.20
7"-8"-9"	.14	.12	.23
10-11-12"	.18	.15	.25

Postage 3c per pair, on Rubber Tired Wheels, 4c pair

WING & TAIL LIGHTS

12"	10c
15"	Set of 3. 15c
24"	20c

ILLUMINATING LIGHTS for Gas models... $1.00 Set

IMPORTANT—Minimum order, 50c. Add postage on all items but if over 15c on less than $1.50 order add only 15c. Orders over $1.50 add 10%; west of Denver 15%.

Send 5c for Catalog Listing Largest Line of Model Airplane Accessories in the World.

SELLEY MFG. CO. INC. DEPT 404 1373 GATES AVENUE, BROOKLYN, N. Y.

Homing Compass

(*Continued from page 40*)

success. An appropriate example is Ray W. Brown, longtime pilot for the General Tire and Rubber Co., at Akron, Ohio, and an official of the contest board of the National Aeronautic Association.

When radio compasses (or homing devices, direction finders, etc.) made their appearance some time ago, Brown became interested in them and had one installed on his company's Lockheed Vega. It was in that ship and with that compass that Brown then proved to himself and to the aviation world that that instrument is vitally necessary to safe airline operations.

In 1935 Brown circled the entire eastern section of the United States in one day. Much of this trip was made by using the radio compass and by tuning to regular radio stations of the various cities he visited. Upon landing at his final destination Brown pronounced the instrument an unquestionable success.

Some time later, in April, 1936, Brown happened to be flying with his radio compass one particularly bad day when, near Uniontown, Pa., an airliner became lost and crashed, killing several passengers. It was Brown's belief following the crash that the airliner's pilot would not have become lost between two airway beams had he been using a radio direction finder on his ship.

"On the day this crash occurred," Brown said later, "I had used my radio direction finder in a matter of triangulation successfully. I used Goshen and Terre Haute, Ind., and Cleveland, Ohio, as points of triangulation.

"I did quite a bit of flying in a heavy storm and took a terrific buffeting. I had to fly on instruments for almost an hour at altitudes of from 5,000 to 20,000 feet. Frankly, I had become completely confused. I throttled down and shed considerable ice, then proceeded on a problem of triangulation with these three cities I mentioned.

Finally, I determined that I was 20 to 25 miles east of Terre Haute and heading directly for that place. I simply reversed my direction, tuned in on WWO at Cleveland as a homing point and soon I was able to drop to 2,500 feet where I broke through the overcast.

"Near Bucyrus, Ohio, the storm was moving in rapidly above me but I changed my homing point to a commercial station (WADC at Akron) and rode home safely. I had been on the ground only 10 minutes when the weather bureau reported a 50-mile gale and snow and fog were so heavy that the terminal dock across the Akron airport could not be distinguished. The airlines had their ships down and schedules halted."

It is the firm belief of many pilots and authorities who have used or seen the radio direction finder in operation that that instrument would have eliminated most of the recent airline accidents. Again quotting Brown, this time concerning the miraculous crash landing on a mountainside near Port Jarvis, N. Y., of an Eastern Airlines Douglas on Dec. 19, 1936, by Dick Merrill:

"The time has come to quit dodging issues. We definitely know that radio direction finders would have functioned in recent crashes without trouble. The fact that Dick Merrill said he could not read the radio beam is conclusive evidence that a radio direction finder should and could have been used. At no time during a storm which could have caused severe crashes has my own radio direction finder failed to function perfectly.

"I am approaching the 1,700-hour mark behind my radio direction finder and have worked more than 500 problems of various combinations. My feeling is that present radio beams are as obsolete as a 1910 Model T Ford and that the sooner we discard the beam and perfect the radio direction finder, the quicker air transportation will come into its own."

Concerning TWA's adoption of the new loop antenna and direction finder, Eugene L. Vidal, director of the Bureau of Air Commerce, said:

". . . it appears that TWA is not only successfully eliminating snow and rain static from radio reception on the planes, but it is operating satisfactorily a new direction finder and homing device. Successful operation of the latter is indeed gratifying to the Department of Commerce since we have been fostering this department several years knowing that the resultant new system of air navigation supplementing the present difficult beam method of navigation would be a most important step forward in increased safety in air travel . . ." END

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619 S. Federal St., Dept. P.A. 4, CHICAGO, ILL.

Joy Stick

(*Continued from page 40*)

or unitary tail surface of an airplane, and so construed is not infringed.

"The vertical control lever did not constitute invention over the structure disclosed in the respondent's 1906 French patent, application for which was filed more than one year before that for the patent in suit. The claims are not supported by the disclosure. Plaintiff's patent is invalid because the claims on the control lever were not inserted in the application until five and one-half years after filing, while the device came into general use in the United States prior to that time."

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RUSH DIME FOR CIRCULAR
MEAD GLIDERS 15 S. Market Dept. E-47 **CHICAGO**

What Our Readers Are Building

(*Continued from page* 45)

A rough estimate indicates that we have about fifteen readers with planes now under construction, and about as many more fellows making major alterations on their existing ships. This means that there will be about thirty ships in the air, this spring and summer, that will give us something to talk about.

One of the most revolutionary of the new projects is an "all-veneer" type with a wood veneer monocoque fuselage, laminated wood wing spars and a wood veneer covering of very original design. It is claimed that the weight will not be more than 2 per cent greater than the same size ship with a steel stube frame and that it shows many points of superiority over the tube type—which is easy to believe.

One of the outstanding advantages of this sort of construction is its integrity and ease of construction. There are no welded joints to make and the ship must be in perfect alignment at all times. The shock absorbing ability is greater than that of a steel tube frame and the nature of the structure is such that the vibration is reduced to a minimum. All fabric is eliminated and there are many other advantages that we will name later.

Another reader tells us of a novel conversion that he is building that seems to be a good idea. Instead of converting a motorcycle engine into the conventional "in-line" type, he is using five Harley-Davidson air-cooled cylinders in the construction of a radial type engine that has a full twenty per cent greater output than the in-line engine. The greatest difficulty experienced with this construction is in the design of the connecting rod connections to the wrist and crank-pins, but he claims that he has solved this problem in a simple but effective manner.

This is not the first radial engine to be constructed from motorcycle cylinders. J. B. R. built a number of these engines 'way back in 1919-1920 that flew "star" biplanes with fair success—good for that time and fair for the present era. In the case of these engines, the major difficulty was in the camshaft and cam-gear arrangement, which made special gearing necessary.

One of the most interesting reports received, is a letter to the effect that an amateur somewhere in Wisconsin is employing an old Wright Brothers engine such as employed on the old Model "B" Wright. This is an old four-cylinder watercooled engine, built in 1909 so that this old kicker is 28 years old.

END

COLT 45 Cal. "FRONTIER" MODEL $1.45

Basswood construction kit with working plans, machined barrel, cylinder and all necessary hardware.

COLT 45 Cal. "FRONTIER" model kit, 4¾" barrel. $1.45
COLT 45 Cal. "FRONTIER" model kit, 5½" barrel. 1.55
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COLT 45 Cal. Automatic Pistol kit. 1.00
Half scale Thompson Sub Machine Gun model kit. ... 1.00
Full scale Thompson Sub Machine Gun model kit. ... 3.00
SAVAGE Cal. 32 Auto. Pistol kit, machined barrel.. .75
LUGER Auto. Pistol with 4" machined barrel. 1.75
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COLT 25 Cal. Automatic Pistol kit. ..... .50

These beautiful kits are complete in every detail and made of the best basswood. All parts are cut to shape and require only a short time to finish. Postpaid in U. S. A.

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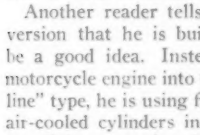

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1/32x3/32	.25
⅛x⅛	.30
⅛x3/16	.50
¼x¼	.55
⅛x⅜	.65
3/16x3/16	.50
3/16x¼	.60
¼x¼	.85
¼x⅜	1.25
¼x½	1.60
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If 3" Widths Are Desired Double Price of 2" Widths.

FRESH PARA RUBBER

1/32 sq., 225"	.20
.045 sq., 225"	.30
3/32 flat, 225"	.30
⅛ flat, 225"	.35
3/16 flat, 225"	.55

Per Pound, any size .80

INSIGNIA SHEET
12 pr. & rudder and tail markings with air line markings.

12 Sheets	.36
50 Sheets	1.25
100 Sheets	1.75

SANDPAPER
5 Pieces to the Pack
Per doz. pkgs. .25

BALSA PLANKS
36" Lengths

1x1, each	.06
1x1½, each	.09
1x2, each	.15
1x3, each	.20
1x6, each	.35
1½x1½, each	.25
2x2, each	.25
2x3, each	.35
2x6, each	.60

STANDARD PITCH BALSA PROPELLER BLOCKS
Per Dozen

½x⅝x5	.05
½x⅝x6	.06
¾x1x7	.12
¾x1x8	.16
¾x1¼x10	.29
¾x1¼x12	.30
1x1½x12	.35
1x1½x15	.50

BAMBOO
1/16 sq. x 14.
1 gross for .10
1/16x¼x11.
1 doz. for .05
1/16x¼x11.
1 gross for .45

REED

1/32 dia. .50 ft.	.15
1/16 dia. .50 ft.	.18
3/32 dia. .50 ft.	.20
⅛ dia. .50 ft.	.25

DOWELS
1/16 dia. x 12",

100 for	.55
25 for	.20

WOOD VENEER
(For scale model work)
20"x30", 3 sheets for .25

COLORLESS CEMENT

1-oz., per ½ doz.	.22
2-oz., per ½ doz.	.40
4-oz., per ½ doz.	.70
1 pt., each	.40
1 qt., each	.70
1 gallon	1.75

SPECIAL COLORLESS CEMENT
1 gallon, each.. 2.00
Clear Dope, Banana Oil or Thinner same price as cement

ALUMINUM
4x6 sheets, per doz. .24

MODEL MOUNTS
A Beautiful Pedestal for Your Airplanes
Per dozen .48

SPECIAL CLEAR DOPE
1 gallon, each.. 1.75

HIGH GLOSS
To shine up colored models.

1-oz., per ½ doz.	.30
2-oz., per ½ doz.	.55
4-oz., per ½ doz.	1.00

COLORED DOPE
White, yellow, orange blue, red, green, olive, drab, black, silver, gold or gray.

1-oz., per ½ doz.	.25
2-oz., per ½ doz.	.45
4-oz., per ½ doz.	1.00
1 pt., each	.40
1 qt., each	.75
1 gallon, each..	2.00

TISSUE "AA" QUALITY WHITE
20 x 24

1 doz.	.10
½ ream	2.00
1 ream, 500 sheets	3.75

TISSUE "AA" QUALITY COLORED
20 x 24
Red, blue, black, orange, green, yellow, olive, drab.

1 doz.	.15
½ ream	3.00
1 ream, 500 sheets	4.50

SILVER TISSUE
Per doz. sheets.. .21

GENUINE SUPER-FINE TISSUE
(Cover your champion endurance ships with this paper.)
18x24, per doz... .50

ALUMINUM LEAF
.0003.....100 ft. .35

SHEET ALUMINUM

.002, 5 ft.	.35
.005, 5 ft.	.50
.010, 5 ft.	.75

ALUMINUM TUBING
(Special 1/100" wall.)

1/16 O.D., 5 ft.	.28
3/32 O.D., 5 ft.	.30
⅛ O.D., 5 ft.	.30
3/16 O.D., 5 ft.	.38
¼ O.D., 5 ft.	.43

WHEELS
Per Doz.

	Brch	Blsa	Cellu
½	.05	.09	
⅝	.06	.11	.21
¾	.08	.14	.22
1	.10	.19	.31
1¼	.15	.35	.55
2	.30	.75	.95

WASHERS PER 100
⅛ brass O. D.... .05
¼ copper O. D. .05

BRASS BUSHINGS OR EYELETS

1/16 dia. per 100	.12
3/32 dia. per 100	.15
⅛ dia. per 100	.18

DIAMOND Always Leads

Thousands of satisfied customers will testify to: (1) that our prices are the lowest; (2) that our supplies are the finest quality merchandise; (3) that we ship your order same day received.

DUMMY RADIAL ENGINES
(Celluloid, 9 cyl.)

1½" 1 doz. for.	.35
2" 1 doz. for.	.45
3" 1 doz. for.	.60

CELLULOID MOTOR AND DRAG RING COMBINED

1½" dia., 3 for.	.45
2" dia., 3 for.	.75

NOSE PLUGS, HARDWOOD

1 doz.	.05
100	.40
Large, per doz.	.10
Per 100	.75

PROP SHAFTS
(Hard Steel)
One size fits all models

Per dozen	.10
Per gross	.72

REAR HOOKS
(Hard Steel)
One size fits all models

Per dozen	.10
Per gross	.72

CELLULOID PANTS

For ⅝" or 1" wheels, ½ doz.	.50
For 1⅜" or 1⅞" wheels, ½ doz.	.75

¾ FINISHED BALSA WHEEL PANTS
Ready for final sanding. To fit:

½" wheels, 6 pr.	.36
⅝" wheels, 6 pr.	.36
1" wheels, 6 pr.	.36
1⅜" wheels, 6 pr.	.54
1⅞" wheels, 6 pr.	.54

THRUST BEARINGS
(Hard Steel)

Small, per doz.	.06
Small, per gross	.50
Large, per doz.	.07
Large, per gross	.65

WIRE, PER 100 FT.
(Straight Lengths)

No. 6	.18
No. 8	.23
No. 10	.25
No. 12	.30
No. 14	.30

2-BLADED PROPS
(Die Cast)

1½" long, 3 for.	.10
2½" long, 3 for.	.14
3½" long, 3 for.	.18
4½" long, 3 for.	.22

3-BLADED PROPS
(Die-Cast)

1½" long, 3 for.	.12
2½" long, 3 for.	.16
3½" long, 3 for	.20
4½" long, 3 for	.26

DIE-CAST WING AND TAIL LIGHTS
3 Pcs. to a Set

For 12" model, 3 sets	.15
For 15" model, 3 sets	.15
For 24" model, 3 sets	.20

SHEET CELLULOID
(Transparent)

12½x16, each	.19
6x8, doz.	.65

MODEL PINS
Per doz. pkgs. .35

PURSUIT OR SWIVEL MACHINE GUNS
(Die Cast)

⅝" long, 3 for.	.03
1¼" long, 3 for.	.05
1⅞" long, 3 for.	.08

ACCESSORIES
Aluminum Cowls
Anti-drag rings, closed N.A.C.A. or open N.A.C.A. cowls.

1", 3 for	.22
1½" 3 for	.25
2" 3 for	.35
2½", 3 for	.43
3", 3 for	.50

PLANS IS FLYING
Fokker D7, Curtiss Robin
Per dozen .30
Per 100 2.00

MACHINE CUT PROPS

5" per doz.	.22
6" per doz.	.25
7" per doz.	.35
8" per doz.	.38
9" per doz.	.40
10" per doz.	.50
12" per doz.	.60

DIE-CAST BOMBS

⅝" long, 3 for.	.05
1½" long, 3 for.	.10
3" long, 3 for.	.18

HOW TO ORDER No orders under $2.50 . . . all orders shipped express collect at these low prices.

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